Operations Manual

OM 1191

Group: **Applied Air Systems**
Part Number: **OM 1191**
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Daikin MD5

Variable Frequency Drive Controller

People and ideas you can trust.™

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Use of Warnings and Notes

There are two types of safety instructions throughout this manual:

- Notes draw attention to a particular condition or fact, or give information on a subject.
- Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. The warning symbols are used as follows:

Electricity warnings warn of hazards from electricity which can cause physical injury and/or damage to the equipment.

General warnings warn about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

⚠ DANGER

The MD5 adjustable speed AC drive should ONLY be installed by a qualified electrician.

⚠ DANGER

Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 (L1, L2, L3) and U2, V2, W2 (T1, T2 T3) and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.

⚠ DANGER

Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.

⚠ DANGER

Even when power is switched off from the input terminals of the MD5, there may be dangerous voltage (from external sources) on the terminals of the relay outputs.

⚠ DANGER

When the control terminals of two or more drives are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the drives or an external supply.

⚠ DANGER

Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system).

⚠ DANGER

Do not attempt to install or remove EM1, EM3, F1 or F2 screws while power is applied to the drive's input terminals.

⚠ WARNING

Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel keys or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

⚠ WARNING

Never attempt to repair a malfunctioning MD5; contact the factory or your local Authorized Service Center for repair or replacement.

⚠ WARNING

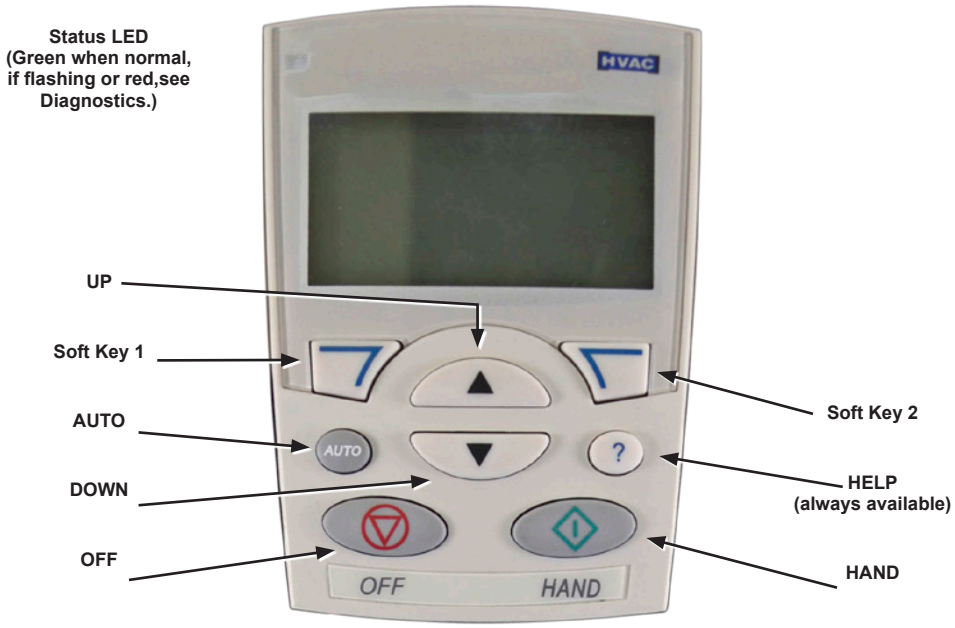
The MD5 will start up automatically after an input voltage interruption if the external run command is on.

⚠ WARNING

The heat sink may reach a high temperature. Note: For more technical information, contact the factory or your local Daikin representative.

MD5 HVAC Control Panel Features

Figure 1: MD5 HVAC Control Panel Features



- Language selection for the display
- Drive connection that can be made or detached at any time
- Start-up assistant to facilitate drive commissioning
- Copy function for moving parameters to other MD5 drives
- Backup function for saving parameter sets
- Context sensitive help
- Real-time clock

General Display Features

Soft Key Functions

The soft key functions are defined by text displayed just above each key.

Display Contrast

To adjust display contrast, simultaneously press and or , as appropriate.

HVAC Control Panel Modes

The HVAC control panel has several different modes for configuring, operating and diagnosing the drive. The modes are:

- Standard Display Mode – Shows drive status information and operates the drive.
- Parameters Mode – Edits parameter values individually.
- Start-up Assistant Mode – Guides the start-up and configuration.
- Changed Parameters Mode – Shows changed parameters.
- Fault Logger Mode – Shows the drive fault history.
- Drive Parameter Backup Mode – Stores or uploads the parameters.
- Clock Set Mode – Sets the time and date for the drive.
- I/O Settings Mode – Checks and edits the I/O settings.
- Alarm Mode – Reporting mode triggered by drive alarms.

Standard Display Mode

Use the Standard Display Mode to read information on the drive's status and to operate the drive. To reach the Standard Display Mode, press EXIT until the LCD display shows status information.

Status Information

Table 1: Status Information

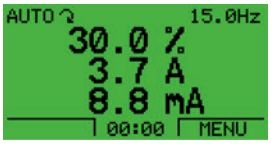
Control Panel Display	Significance
Rotating arrow (clockwise or counterclockwise)	• Drive is running and at setpoint • Shaft direction is forward or reverse
Rotating dotted arrow blinking	Drive is running but not at setpoint
Stationary dotted arrow	Start command is present, but motor is not running. E.g. start enable is missing.

Top. The top line of the LCD display shows the basic status information of the drive.

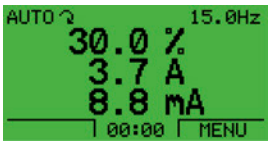
- **HAND** – Indicates that the drive control is local, that is, from the control panel.
- **AUTO** – Indicates that the drive control is remote, such as the basic I/O (X1) or fieldbus.
- ↻ – Indicates the drive and motor rotation status as follows:

Upper right – shows the active reference.

Middle. Using Group 34: Panel Display, the middle of the LCD display can be configured to display:



- One to three parameter values – The default display shows parameters 0103 (OUTPUT FREQ) in percentages, 0104 (CURRENT) in amperes and 0120 (AI1) in milliamperes.
  - Use parameters 3401, 3408, and 3415, see page 34, to select the parameters (from Group 01) to display. Entering "parameter" 0100 results in no parameter displayed. **For example,** if 3401 = 0100 and 3415 = 0100, then only the parameter specified by 3408 appears in the Control Panel display.
  - You can also scale each parameter in the display, for example, to convert the motor speed to a display of conveyor speed. Parameters 3402…3405 scale the parameter specified by 3401, parameters 3409…3412 scale the parameter specified by 3408, etc.
- A bar meter rather than one of the parameter values.
  - Enable bar graph displays using parameters 3404, 3411 and 3418.



Bottom. The bottom of the LCD display shows:

- **Lower corners** – show the functions currently assigned to the two soft keys.
- **Lower middle** – displays the current time (if configured to show the time).

Operating the Drive

Auto/Hand – The very first time the drive is powered up, it is in the auto control (AUTO) mode, and is controlled from the Control terminal block X1.

To switch to hand control (HAND) and control the drive using the control panel, press and hold the ◇ or ▽ button.

- Pressing the HAND button switches the drive to hand control while keeping the drive running.
- Pressing the OFF button switches to hand control and stops the drive.

To switch back to auto control (AUTO), press and hold the AUTO button.

Hand/Auto/Off – To start the drive press the HAND or AUTO buttons, to stop the drive press the OFF button.

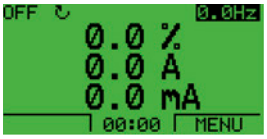
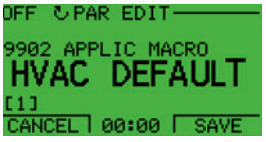
Reference – To modify the reference (only possible if the display in the upper right corner is in reverse video) press the UP or DOWN buttons (the reference changes immediately).

The reference can be modified in the local control mode (HAND/OFF), and can be parameterized (using Group 11: Reference Select) to also allow modification in the remote control mode.

NOTE: The Start/Stop, Shaft direction and Reference functions are only valid in local control (HAND/OFF) mode.

Figure 2: Parameters Mode

To change the parameters, follow these steps:

1	Select MENU to enter the main menu.		
2	Select the Parameters mode with the UP/ DOWN buttons, and select ENTER to select the Parameters Mode.		
3	Select the appropriate parameter group with the UP/ DOWN buttons and select SEL.		
4	Select the appropriate parameter in a group with the UP/ DOWN buttons. Select EDIT to change the parameter.		
5	Press the UP/DOWN buttons to change the parameter value.		
6	Select SAVE to store the modified value or select CANCEL to leave the set mode. • Any modifications not saved are cancelled. • Each individual parameter setting is valid immediately after pressing SAVE.		
7	Select EXIT to return to the listing of parameter groups, and again to return to the main menu.		

For detailed hardware description, see the Appendix on page 88.

NOTE: The current parameter value appears below the highlighted parameter.

To view the default parameter value, press the UP/ DOWN buttons simultaneously.

The most typical and necessary parameters to change are parameter groups 99 Start-up data, 10 Start/Stop/Dir, 11 Reference Select, 20 Limits, 21 Start/Stop, 22 Accel/Decel, 26 Motor Control and 30 Fault Functions.

To restore the default factory settings, select the application macro HVAC Default.

Figure 3: Start-Up By Changing the Parameters Individually

To change the parameters, follow these steps:

1	Select MENU to enter the main menu.		
2	Select the Parameters mode with the UP/DOWN buttons and select ENTER to select the Parameters mode.		
3	Select the appropriate parameter group with the UP/DOWN buttons and select SEL		
4	Select the appropriate parameter in a group with the UP/DOWN buttons. Select EDIT to change the parameter value.		
5	Press the UP/DOWN buttons to change the parameter value.		
6	Select SAVE to store the modified value or select CANCEL to leave the set mode. Any modifications not saved are cancelled.		
7	Select EXIT to return to the listing of parameter groups, and again to return to the main menu.		

To complete the control connections by manually entering the parameters, see Parameters on page 12

For detailed hardware description, see the Technical Data on page 82.

NOTE: The current parameter value appears below the highlighted parameter.

To view the default parameter value, press the UP/DOWN buttons simultaneously.

The most typical and necessary parameters to change are parameter groups 99 Start-up data, 10 Start/Stop/Dir, 11 Reference Select, 20 Limits, 21 Start/Stop, 22 Accel/Decel, 26 Motor Control and 30 Fault Functions.

To restore the default factory settings, select the application macro HVAC Default.

Overview

Macros change a group of parameters to new, predefined values designed for specific applications. Use macros to minimize the need for manual editing of parameters. Selecting a macro sets (always use HVAC Defaults) all other parameters to their default values, except:

- Group 99: Start-up Data parameters (except parameter 9904)
- The PARAMETER LOCK 1602
- The PARAM SAVE 1607
- The COMM FAULT FUNC 3018 and COMM FAULT TIME 3019
- The COMM PROT SEL 9802
- Groups 51…53 serial communication parameters
- Group 29: Maintenance triggers

After selecting a macro, additional parameter changes can be made manually using the control panel.

Application macros are enabled by setting the value for parameter 9902 APPLICMACRO. By default, HVAC Default (value 1) is the enabled macro.

General Considerations

The following considerations apply for all macros:

- When using a direct speed reference in AUTO mode, connect the speed reference to analog input 1 (AI1), and provide the START command using digital input 1 (DI1). In HAND/OFF mode, the control panel provides the speed reference and START command.
- When using process PID, connect the feedback signal to analog input 2 (AI2). As a default, the control panel sets the Setpoint, but analog input 1 can be used as an alternate source. You can set up process PID using parameters (Group 40) or using the PID control assistant (recommended).

Table 2: Application/Macro Listing

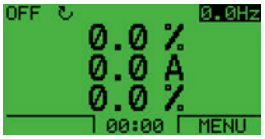
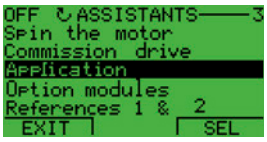
This describes the following macros:

9902 Value	Macro
1	HVAC Default**
2	Supply Fan
3	Return Fan
4	Condenser
6	Booster Pump
7	Pump Alternation
8	Internal Timer
9	Internal Timer with Constant Speeds
10	Floating Point
11	Dual Setpoint PID
12	Dual Setpoint PID with Constant Speeds
13	E-bypass
14	Hand Control
15	E-Clipse

** Daikin users must use the HVAC Defaults

Figure 4: Selecting an application macro

To select a macro, follow these steps:

1	Select MENU to enter the main menu.		
2	Select ASSISTANTS with the UP/DOWN buttons and select ENTER.		
3	Scroll to APPLICATION and select ENTER.		
4	Select a macro with the UP/DOWN buttons and select SAVE.		

Restoring defaults

To restore the factory default settings, select the application macro HVAC Default.

Control wiring

Each macro has specific requirements for control wiring. For general details about the MD5 control wiring terminals, see Control Terminal Descriptions on page 85. Specific wiring requirements are included with each macro description.

HVAC Default macro

This macro provides the factory default parameter settings for the MD5-UH. Factory defaults can be restored at any time by setting parameter 9902 to 1. The diagram below shows typical wiring using this macro. When using direct speed reference in AUTO mode or process PID, see General Considerations on page 9.

Figure 5: MD5 HVAC Defaults

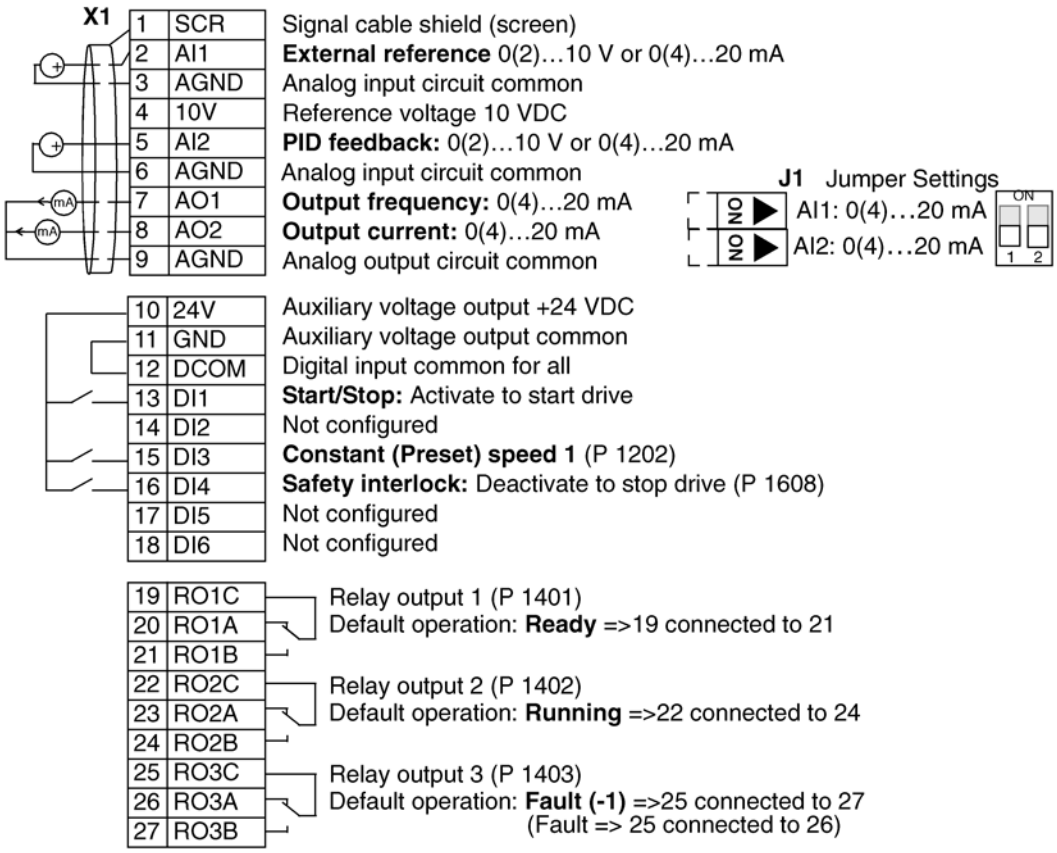


Table 3: Parameters Changed Relative to HVAC Default

Parameter	Value	Parameter	Value
None (Default macro)			

Parameter List

The following parameters are important on Daikin applications. A summary is shown in Table 63: Parameter Settings on page 89. All other should not be adjusted. Parameter data is specific to MD5 firmware version 2.13.

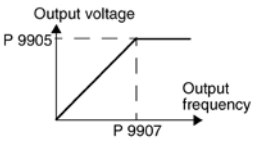
Group 99: Start-Up Data

This group defines special Start-up data required to:

- Set up the drive.
- Enter motor information

NOTE: Parameters checked under the heading “S” can be modified only when the drive is stopped.

Table 4: Group 99: Start-up Data

Code	Description	Range	Resolution	Default	S
9901	LANGUAGE	0…16	1	0 (ENGLISH)	
	Selects the display language. 0 = ENGLISH 1 = ENGLISH (AM) 2 = DEUTSCH 3 = ITALIANO 4 = ESPAÑOL 5 = PORTUGUES 6 = NEDERLANDS 7 = FRANCAIS 8 = DANSK 9 = SUOMI 10 = SVENSKA 11 = RUSSKI 12 = POLSKI 13 = TÜRKCE 14 = CZECH 15 = MAGYAR 16 = RESERVED				
9902	APPLIC MACRO	-3…15, 31	1	1(HVAC DEFAULT)	☑
	Selects an application macro. Application macros automatically edit parameters to configure the MD5 for a particular application. See Application macros for application macro descriptions. 1= HVAC DEFAULT 2= SUPPLY FAN 3= RETURN FAN 4= COOLING TOWER FAN 5= CONDENSER 6= BOOSTER PUMP 7= PUMP ALTERNATION 8= INTERNAL TIMER 9= INTERNAL TIMER WITH CONSTANT SPEEDS 10= FLOATING POINT 11= DUAL SETPOINT PID 12= DUAL SETPOINT PID WITH CONSTANT SPEEDS 13= E-BYPASS 14= HAND CONTROL 15= E-CLIPSE 31 = LOAD FD SET - FrontDrop parameter values as defined by the FlashDrop file. Parameter view is selected by parameter 1611 PARAMETER VIEW. • FlashDrop is an optional device for fast copying of parameters to unpowered drives. FlashDrop allows easy customization of the parameter list, e.g. selected parameters can be hidden. For more information, see MFDT-01 FlashDrop User’s Manual [3AFE68591074 (English)]. -1 = USER S1 SAVE, -3 = USER S2 SAVE - With these it is possible to save two different user parameter sets into the drive permanent memory for later use. Each set contains parameter settings, including Group 99: START-UP DATA, and the results of the motor identification run. 0 = USER S1 LOAD, -2 = USER S2 LOAD - With these the user parameter sets can be taken back in use.				
9905	MOTOR NOM VOLT	115…345 V (200 V, US) 230…690 V (400 V, US) 288…862 V (600 V, US)	1 V 1 V 1 V	230 V (US) 460 V (US) 575 V (US)	☑
	Defines the nominal motor voltage. • Must equal the value on the motor rating plate. • The MD5 cannot supply the motor with a voltage greater than the input power (mains) voltage.				
9906	MOTOR NOM CURR	0.15 · $I2_n$ … 1.5 · $I2_n$	0.1 A	1.0 · $I2_n$	☑
	Defines the nominal motor current. • Must equal the value on the motor rating plate. • Range allowed: 0.15…1.5 · $I2_n$ (where $I2_n$ is drive current).				
9907	MOTOR NOM FREQ	10.0…500.0 Hz	0.1 Hz	60.0 Hz (US)	☑
	Defines the nominal motor frequency. • Range: 10…500 Hz (typically 50 or 60 Hz) • Sets the frequency at which output voltage equals the MOTOR NOM VOLT. • Field weakening point = Nom Freq · Supply Volt / Mot Nom Volt				
9908	MOTOR NOM SPEED	50…30000 rpm	1 rpm	Size dependent	☑
	Defines the nominal motor speed. • Must equal the value on the motor rating plate.				
9909	MOTOR NOM POWER	0.15… 1.5 · P_n	0.1 hp	1.0 · P_n	☑
	Defines the nominal motor power. • Must equal the value on the motor rating plate.				

Group 01: Operating Data

This group contains drive operating data, including actual signals. The drive sets the values for actual signals, based on measurements or calculations. You cannot set these values.

Table 5: Group 01: Operating Data

Code	Description	Range	Resolution	Default	S
0101	SPEED & DIR	-30000… 30000 rpm	1 rpm	—	
	The calculated signed speed of the motor (rpm). The absolute value of 0101 SPEED & DIR is the same as the value of 0102 SPEED. • The value of 0101 SPEED & DIR is positive if the motor runs in the forward direction. • The value of 0101 SPEED & DIR is negative if the motor runs in the reverse direction.				
0102	SPEED	0…30000 rpm	1 rpm	—	
	The calculated speed of the motor (rpm).				
0103	OUTPUT FREQ	0.0…500.0 Hz	0.1 Hz	—	
	The frequency (Hz) applied to the motor.				
0104	CURRENT	0.0…1.5 × $I2_n$	0.1 A	—	
	The motor current, as measured by the MD5.				
0105	TORQUE	-200.0… 200.0%	0.1%	—	
	Output torque. Calculated value of torque on motor shaft in % of motor nominal torque.				
0106	POWER	-1.5…1.5 × P_n	0.1 kW	—	
	The measured motor power in kW.				
0107	DC BUS VOLTAGE	0…2.5 × VdN	1 V	—	
	The DC bus voltage in V DC, as measured by the MD5.				
0109	OUTPUT VOLTAGE	0…2.0 × V_{dN}	1 V	—	
	The voltage applied to the motor.				
0110	DRIVE TEMP	0.0…150.0 °C	0.1 °C	—	
	The temperature of the drive power transistors in degrees Celsius.				
0111	EXTERNAL REF	1 0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	—	
	External reference, REF1, in rpm or Hz – units determined by parameter 9904.				
0112	EXTERNAL REF 2	0.0…100.0% (0.0…600.0% for torque)	0.1%	—	
	External reference, REF2, in %.				
0113	CTRL LOCATION	0…2	1	—	
	Active control location. Alternatives are: 0 = LOCAL 1 = EXT1 2 = EXT2				
0114	RUN TIME (R)	0…9999 h	1 h	—	
	The drive's accumulated running time in hours (h). • Can be reset by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode.				
0115	KWH COUNTER (R	0…65535 kWh	1 kWh	—	
	The drive's accumulated power consumption in kilowatt hours. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Can be reset by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode. MD5-UH User's Manual 1-83 Parameters				
0116	APPL BLK OUTPUT	0.0…100.0% (0.0…600.0% for torque)	0.1%	—	
	Application block output signal. Value is from either: • PFA control, if PFA Control is active, or • Parameter 0112 EXTERNAL REF 2.				

Table 5 continued: Group 01: Operating Data

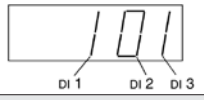
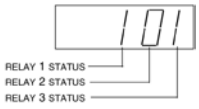
0118	DI 1-3 STATUS	000…111 (0…7 decimal)	1	—	
	Status of the three digital inputs. • Status is displayed as a binary number. • 1 indicates that the input is activated. • 0 indicates that the input is deactivated. 				
0119	DI 4-6 STATUS	000…111 (0…7 decimal)	1	—	
	Status of the three digital inputs. • See parameter 0118 DI 1-3 STATUS.				
0120	**AI 1**	**0.0…100.0%**	**0.1%**	**—**	
	The relative value of analog input 1 in %.				
0121	AI 2	0.0…100.0%	0.1%	—	
	The relative value of analog input 2 in %.				
0122	RO 1-3 STATUS	000…111 (0…7 decimal)	1	—	
	Status of the three relay outputs. • 1 indicates that the relay is energized. • 0 indicates that the relay is de-energized. 				
0123	RO 4-6 STATUS	000…111 (0…7 decimal)	1	—	
	Status of the three relay outputs. Available if OREL-01 Relay Output Extension Module is installed. • See parameter 0122.				
0124	AO 1	0.0…20.0 mA	0.1 mA	—	
	The analog output 1 value in milliamperes.				
0125	AO 2	0.0…20.0 mA	0.1 mA	—	
	The analog output 2 value in milliamperes.				
0126	PID 1 OUTPUT	-1000.0… 1000.0%	0.1%	—	
	The PID controller 1 output value in %.				
0127	PID 2 OUTPUT	-100.0… 100.0%	0.1%	—	
	The PID controller 2 output value in %.				
0128	PID 1 SETPNT	Unit and scale defined by par. 4006/4106 and 4007/4107	—	—	
	The PID 1 controller setpoint signal. • Units and scale defined by PID parameters.				
0129	PID 2 SETPNT	Unit and scale defined by par. 4206 and 4207	—	—	
	The PID 2 controller setpoint signal. • Units and scale defined by PID parameters.				
0130	PID 1 FBK	Unit and scale defined by par. 4006/4106 and 4007/4107	—	—	
	The PID 1 controller feedback signal. • Units and scale defined by PID parameters.				

Table 5 continued: Group 01: Operating Data

0131	PID 2 FBK	Unit and scale defined by par. 4206 and 4207	—	—	
	The PID 2 controller feedback signal. • Units and scale defined by PID parameters.				
0132	PID 1 DEVIATION	Unit and scale defined by par. 4006/4106 and 4007/4107	—	—	
	The difference between the PID 1 controller reference value and actual value. • Units and scale defined by PID parameters.				
0133	PID 2 DEVIATION	Unit and scale defined by par. 4206 and 4207	—	—	
	The difference between the PID 2 controller reference value and actual value. • Units and scale defined by PID parameters.				
0134	COMM RO WORD	0…65535	1	—	
	Free data location that can be written from serial link. • Used for relay output control.				
0135	COMM VALUE 1	-32768… +32767	1	—	
	Free data location that can be written from serial link.				
0136	COMM VALUE 2	-32768… +32767	1	—	
	Free data location that can be written from serial link.				
0137	PROCESS VAR 1	—	1	—	
	Process variable 1 • Defined by parameters in Group 34: Panel Display on page 34.				
0138	PROCESS VAR 2	—	1	—	
	Process variable 2 • Defined by parameters in Group 34: Panel Display on page 34.				
0139	PROCESS VAR 3	—	1	—	
	Process variable 3 • Defined by parameters in Group 34: Panel Display on page 34.				
0140	RUN TIME	0.00…499.99 kh	0.01 kh	—	
	The drive's accumulated running time in thousands of hours (kh). • Cannot be reset.				
0141	MWH COUNTER	0…65535 MWh	1 MWh	—	
	The drive's accumulated power consumption in megawatt hours. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Cannot be reset.				
0142	REVOLUTION CNTR	0…65535 Mrev	1 Mrev	—	
	The motor's accumulated revolutions in millions of revolutions. • Can be reset by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode.				
0143	DRIVE ON TIME HI	0…65535 days	1 day	—	
	The drive's accumulated power-on time in days. • Cannot be reset.				
0144	DRIVE ON TIME LO	00:00:00… 23:59:58	1 = 2 s	—	
	The drive's accumulated power-on time in 2 second ticks (30 ticks = 60 seconds). • Shown in format hh.mm.ss. • Cannot be reset.				

Table 5 continued: Group 01: Operating Data

0145	MOTOR TEMP	Par. 3501 = 1…3: -10…200 °C Par. 3501 = 4: 0…5000 ohm Par. 3501 = 5…6: 0…1	1	—	
	Motor temperature in degrees Celsius / PTC resistance in ohms. • Applies only if motor temperature sensor is set up.				
0150	CB TEMP	-20.0… 150.0 °C	1.0 °C	—	
	Temperature of the drive control board in degrees Celsius. Note: Some drives have a control board (OMIO) that does not support this feature. These drives always show the constant value of 25.0 °C.				
0153	MOT THERM STRESS	0.0…100.0%	0.1%	—	
	Estimated rise of the motor temperature. Value equals to the estimated motor thermal stress as a percentage of the motor temperature trip level.				
0158	PID COMM VALUE 1	-32768… +32767	1	—	
	Data received from fieldbus for PID control (PID1 and PID2).				
0159	PID COMM VALUE 2	-32768… +32767	1	—	
	Data received from fieldbus for PID control (PID1 and PID2).				
0174	SAVED KWH	0.0…999.9 kWh	0.1 kWh	—	
	Energy saved in kWh compared to the energy used when the pump is connected directly to the supply. See the note on page 1-163. • The counter value is accumulated till it reaches 999.9 after which the counter rolls over and starts again from 0.0. • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time).				
0175	SAVED MWH	0…65535 MWh	1 MWh	—	—
	Energy saved in MWh compared to the energy used when the pump is connected directly to the supply. See the note on page 1-163. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time).				
0176	SAVED AMOUNT 1	0.0…999.9	0.1	—	
	Energy saved in local currency (remainder when the total saved energy is divided by 1000). See the note on page 1-163. • To find out the total saved energy in currency units, add the value of parameter 0177 multiplied by 1000 to the value of parameter 0176. **Example:** 0176 SAVED AMOUNT 1 = 123.4 0177 SAVED AMOUNT 2 = 5 Total saved energy = 5 ×1000 + 123.4 = 5123.4 currency units. • The counter value is accumulated till it reaches 999.9 (the counter does not roll over). • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • Local energy price is set with parameter 4502 ENERGY PRICE.				
0177	SAVED AMOUNT 2	0…65535	1	—	
	Energy saved in local currency in thousand currency units. Eg value 5 means 5000 currency units. See the note on page 1-163. • The counter value is accumulated till it reaches 65535 (the counter does not roll over). • See parameter 0176 SAVED AMOUNT 1.				
0178	SAVED CO_2	0.0…6553.5 tn	0.1 tn	—	
	Reduction of carbon dioxide emissions in tons. See the note on page 1-163. • The counter value is accumulated till it reaches 6553.5 (the counter does not roll over). • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • CO_2 conversion factor is set with parameter 4507 CO_2 CONV FACTOR.				

Group 03: Actual Signals

This group monitors fieldbus communications.

Table 6: Group 03: Actual Signals

Code	Description	Range	Resolution	Default	S
0301	FB CMD WORD 1	—	1	—	
	Read-only copy of the Fieldbus Command Word 1. • The fieldbus command is the principal means for controlling the drive from a fieldbus controller. The command consists of two Command Words. Bit-coded instructions in the Command Words switch the drive between states. • To control the drive, using the Command Words, an external location (EXT1 or EXT2) must be active and set to COMM. (See parameters 1001 and 1002.) The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.				

Bit #	0301, FB CMD WORD 1	0302, FB CMD WORD 2
0	STOP	FBLOCAL_CTL
1	START	FBLOCAL_REF
2	REVERSE	START_DISABLE1
3	LOCAL	START_DISABLE2
4	RESET	Reserved
5	EXT2	Reserved
6	RUN_DISABLE	Reserved
7	STPMODE_R	Reserved
8	STPMODE_EM	Reserved
9	STPMODE_C	Reserved
10	RAMP_2	Reserved
11	RAMP_OUT_0	REF_CONST
12	RAMP_HOLD	REF_AVE
13	RAMP_IN_0	LINK_ON
14	RREQ_LOCALLOC	REQ_STARTINH
15	TORQLIM2	OFF_INTERLOCK

0302	FB CMD WORD 2	—	1	—	
	Read-only copy of the Fieldbus Command Word 2. • See parameter 0301.				
0303	FB STS WORD 1	—	1	—	
	Read-only copy of the Status Word 1. • The drive sends status information to the fieldbus controller. The status consists of two Status Words. • The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.				

Bit #	0303, FB STS WORD 1	0304, FB STS WORD 2
0	READY	ALARM
1	ENABLED	NOTICE
2	STARTED	DIRLOCK
3	RUNNING	LOCALLOCK
4	ZERO_SPEED	CTL_MODE
5	ACCELERATE	Reserved
6	DECELERATE	Reserved
7	AT_SETPOINT	CPY_CTL
8	LIMIT	CPY_REF1
9	SUPERVISION	CPY_REF2
10	REV_REF	REQ_CTL
11	REV_ACT	REQ_REF1
12	PANEL_LOCAL	REQ_REF2
13	FIELDBUS_LOCAL	REQ_REF2EXT
14	EXT2_ACT	ACK_STARTINH
15	FAULT	ACK_OFF_ILCK

0304	FB STS WORD 2	—	1	—	
	Read-only copy of the Status Word 2. • See parameter 0303.				

Table 6 continued: Group 03: Actual Signals

0305	FAULT WORD 1	—	1	—	

Read-only copy of the Fault Word 1.
• When a fault is active, the corresponding bit for the active fault is set in the Fault Words.
• Each fault has a dedicated bit allocated within Fault Words.
• See section Fault listing on page 1-282 for a description of the faults.
• The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.

Bit #	0305, FAULT WORD 1	0306, FAULT WORD 2	0307, FAULT WORD 3
0	OVERCURRENT	Obsolete	EFB 1
1	DC OVERVOLT	THERM FAIL	EFB 2
2	DEV OVERTEMP	OPEX LINK	EFB 3
3	SHORT CIRC	OPEX PWR	INCOMPATIBLE SW
4	Reserved	CURR MEAS	USER LOAD CURVE
5	DC UNDERVOLT	SUPPLY PHASE	Reserved
6	AI1 LOSS	ENCODER ERR	Reserved
7	AI2 LOSS	OVERSPEED	Reserved
8	MOT OVERTEMP	Reserved	Reserved
9	PANEL LOSS	DRIVE ID	Reserved
10	ID RUN FAIL	CONFIG FILE	System error
11	MOTOR STALL	SERIAL 1 ERR	System error
12	CB OVERTEMP	EFB CON FILE	System error
13	EXT FAULT 1	FORCE TRIP	System error
14	EXT FAULT 2	MOTOR PHASE	System error
15	EARTH FAULT	OUTP WIRING	Param. setting fault

0306	FAULT WORD 2	—	1	—	

Read-only copy of the Fault Word 2.
• See parameter 0305.

0307	FAULT WORD 3	—	1	—	

Read-only copy of the Fault Word 3.
• See parameter 0305.

0308	ALARM WORD 1	—	1	—	

• When an alarm is active, the corresponding bit for the active alarm is set in the Alarm Words.
• Each alarm has a dedicated bit allocated within Alarm Words.
• Bits remain set until the whole alarm word is reset. (Reset by writing zero to the word.)
• The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.

Bit #	0308, ALARM WORD 1	0309, ALARM WORD 2
0	OVERCURRENT	Reserved
1	OVERVOLTAGE	PID SLEEP
2	UNDERVOLTAGE	ID RUN
3	DIR LOCK	Reserved
4	IO COMM	START ENABLE 1 MISSING
5	AI1 LOSS	START ENABLE 2 MISSING
6	AI2 LOSS	EMERGENCY STOP
7	PANEL LOSS	ENCODER ERROR
8	DEVICE OVERTEMP	FIRST START
9	MOTOR TEMP	Reserved
10	Reserved	USER LOAD CURVE
11	MOTOR STALL	START DELAY
12	AUTORESET	Reserved
13	AUTOCHANGE	Reserved
14	PFA I LOCK	Reserved
15	Reserved	Reserved

0309	ALARM WORD 2	—	1	—	

• See parameter 0308.Group 03: Actual Signals

Group 04: Fault History

This group stores a recent history of the faults reported by the drive.

Table 7: Group 04: Fault History

Code	Description	Range	Resolution	Default	S
0401	LAST FAULT	Fault codes (panel displays as text)	1	0	
	0 – Clear the fault history (on panel = NO RECORD). n – Fault code of the last recorded fault. The fault code is displayed as a name. See section Fault listing on page 1-282 for the fault codes and names. The fault name shown for this parameter may be shorter than the corresponding name in the fault listing, which shows the names as they are shown in the fault display.				
0402	FAULT TIME 1	Date dd.mm.yy / power-on time in days	1 day	0	
	The day on which the last fault occurred. Either as: • A date – if real time clock is operating. • The number of days after power on – if real time clock is not used, or was not set.				
0403	FAULT TIME 2	Time hh:mm:ss	2 s	0	
	The time at which the last fault occurred. Either as: • Real time, in format hh:mm:ss – if real time clock is operating. • The time since power on (minus the whole days reported in 0402), in format hh:mm:ss – if real time clock is not used, or was not set. • Format on the Basic Control Panel: The time since power on in 2-second ticks (minus the whole days reported in 0402). 30 ticks = 60 seconds. E.g. Value 514 equals 17 minutes and 8 seconds (= 514/30).				
0404	SPEED AT FLT	-32768… +32767	1 rpm	0	
	The motor speed (rpm) at the time the last fault occurred.				
0405	FREQ AT FLT	-3276.8… +3276.7	0.1 Hz	0	
	The frequency (Hz) at the time the last fault occurred.				
0406	VOLTAGE AT FLT	0.0…6553.5	0.1 V	0	
	The DC bus voltage (V) at the time the last fault occurred.				
0407	CURRENT AT FLT	0.0…6553.5	0.1 A	0	
	The motor current (A) at the time the last fault occurred.				
0408	TORQUE AT FLT	-3276.8… +3276.7	0.1%	0	
	The motor torque (%) at the time the last fault occurred.				
0409	STATUS AT FLT	0000… FFFF hex	1	0	
	The drive status (hex code word) at the time the last fault occurred.				
0410	DI 1-3 AT FLT	000…111 (0…7 decimal)	1	0	
	The status of digital inputs 1…3 at the time the last fault occurred.				
0411	DI 4-6 AT FLT	000…111 (0…7 decimal)	1	0	
	The status of digital inputs 4…6 at the time the last fault occurred.				
0412	PREVIOUS FAULT 1	As par. 0401	1	0	
	Fault code of the second last fault. Read-only.				
0413	PREVIOUS FAULT 2	As par. 0401	1	0	
	Fault code of the third last fault. Read-on				

Group 10: Start/Stop/Dir

This group:

- Defines external sources (EXT1 and EXT2) for commands that enable start, stop and direction changes
- Locks direction or enables direction control.

To select between the two external locations use the next group (parameter 1102).

Table 8: Group 10: Start/Stop/Dir

Code	Description	Range	Resolution	Default	S
1001	EXT1 COMMANDS	0…14	1	1 (DI1)	☑
	Defines external control location 1 (EXT1) – the configuration of start, stop and direction commands. 0 = NOT SEL – No external start, stop and direction command source. 1 = DI1 – Two-wire Start/Stop. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 2 = DI1,2 – Two-wire Start/Stop, Direction. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI2 (DI2 activated = Reverse; de-activated = Forward). 3 = DI1P,2P – Three-wire Start/Stop. • Start/Stop commands are through momentary push-buttons (the P stands for “pulse”). • Start is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI2 must be activated prior to the pulse in DI1. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI2. • Connect multiple Stop push-buttons in series. • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 4 = DI1P,2P,3 – Three-wire Start/Stop, Direction. • Start/Stop commands are through momentary push-buttons, as described for DI1P,2P. • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI3 (DI3 activated = Reverse; de-activated = Forward). 5 = DI1P,2P,3P – Start Forward, Start Reverse and Stop. • Start and Direction commands are given simultaneously with two separate momentary push-buttons (the P stands for “pulse”). • Start Forward command is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI3 must be activated prior to the pulse in DI1. • Start Reverse command is through a normally open push-button connected to digital input DI2. In order to start the drive, the digital input DI3 must be activated during the pulse in DI2. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI3. • Connect multiple Stop push-buttons in series. • Requires parameter 1003 = 3 (REQUEST). 6 = DI6 – Two-wire Start/Stop. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 7 = DI6,5 – Two-wire Start/Stop/Direction. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI5. (DI5 activated = Reverse; de-activated = Forward). 8 = KEYPAD – Control Panel. • Start/Stop and Direction commands are through the control panel when EXT1 is active. • Direction control requires parameter 1003 = 3 (REQUEST). 9 = DI1F,2R – Start/Stop/Direction commands through DI1 and DI2 combinations. • Start forward = DI1 activated and DI2 de-activated. • Start reverse = DI1 de-activated and DI2 activated. • Stop = both DI1 and DI2 activated, or both de-activated. • Requires parameter 1003 = 3 (REQUEST). 10 = COMM – Assigns the fieldbus Command Word as the source for the start/stop and direction commands. • Bits 0, 1, 2 of Command Word 1 (parameter 0301) activates the start/stop and direction commands. • See Fieldbus user’s manual for detailed instructions. 11 = TIMED FUNC 1. – Assigns Start/Stop control to Timed Function 1 (Timed Function activated = START; Timed Function de-activated = STOP). See on page 35. 12…14 = TIMED FUNC 2…4 – Assigns Start/Stop control to Timed Function 2…4. See TIMED FUNC 1 above.				
1002	EXT2 COMMANDS	0…14	1	1 (DI1)	☑
	Defines external control location 2 (EXT2) – the configuration of start, stop and direction commands. • See parameter 1001 EXT1 COMMANDS above.				
1003	DIRECTION	1…3	1	1 (FORWARD)	☑
	Defines the control of motor rotation direction. 1 = FORWARD – Rotation is fixed in the forward direction. 2 = REVERSE – Rotation is fixed in the reverse direction. 3 = REQUEST – Rotation direction can be changed on command.				

Group 11: Reference Select

This group defines:

- How the drive selects between command sources
- Characteristics and sources for REF1 and REF2.

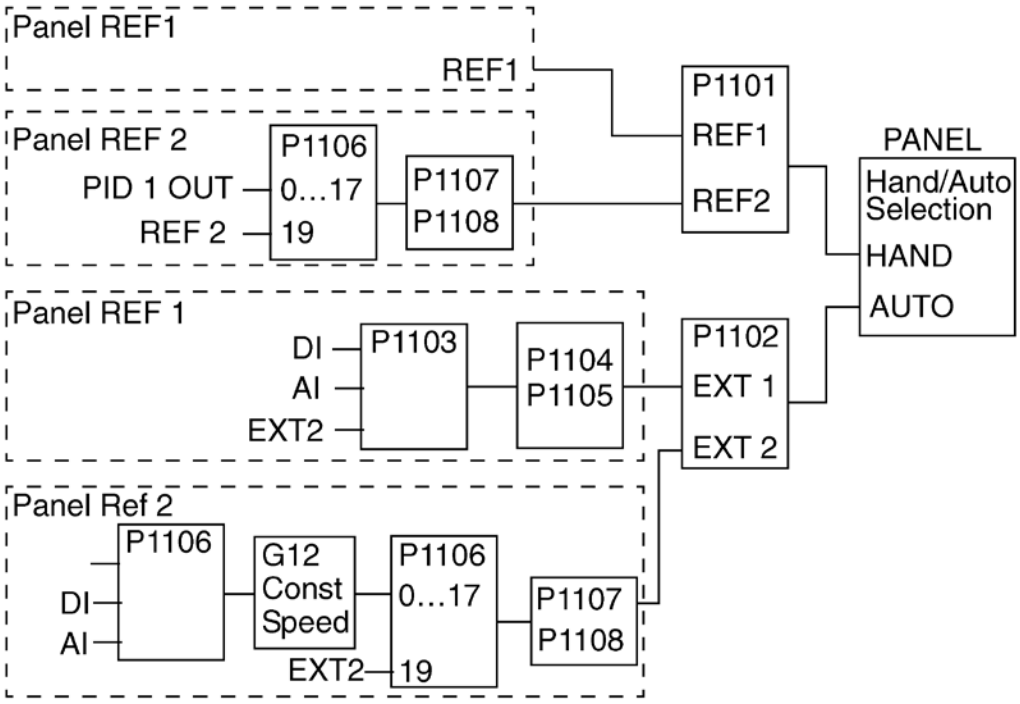


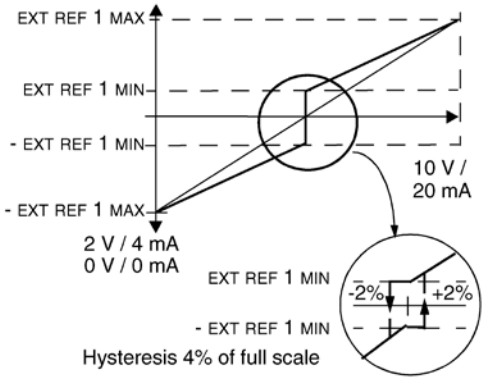
Table 9: Group 11: Reference Select

Code	Description	Range	Resolution	Default	S
1102	EXT1/EXT2 SEL	-6…12	1	0 (EXT1)	☑
	Defines the source for selecting between the two external control locations EXT1 or EXT2. Thus, defines the source for Start/Stop/Direction commands and reference signals. 0 = EXT1 – Selects external control location 1 (EXT1). • See parameter 1001 EXT1 COMMANDS for EXT1's Start/Stop/Dir definitions. • See parameter 1103, page 22 REF1 SELECT for EXT1's reference definitions. 1 = DI1 – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT2; DI1 de-activated = EXT1). 2…6 = DI2…DI6 – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1 above. 7 = EXT2 – Selects external control location 2 (EXT2). • See parameter 1002 EXT2 COMMANDS for EXT2's Start/Stop/Dir definitions. • See parameter 1106 REF2 SELECT for EXT2's reference definitions. 8 = COMM – Assigns control of the drive via external control location EXT1 or EXT2 based on the fieldbus control word. • Bit 5 of the Command Word 1 (parameter 0301) defines the active external control location (EXT1 or EXT2). • See Fieldbus user's manual for detailed instructions. 9 = TIMED FUNC 1 – Assigns control to EXT1 or EXT2 based on the state of the Timed Function (Timed Function activated = EXT2; Timed Function de-activated = EXT1). See on page 35. 10…12 = TIMED FUNC 2…4 – Assigns control to EXT1 or EXT2 based on the state of the Timed Function. See TIMED FUNC 1 above. -1 = DI1(INV) – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT1; DI1 de-activated = EXT2). -2…-6 = DI2(INV)…DI6(INV) – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1(INV) above.				

Table 9 continued: Group 11: Reference Select

1103	REF1 SELECT	0…17, 20…21	1	1 (AI1)	☑

Selects the signal source for external reference REF1.


EXT REF 1 MAX
EXT REF 1 MIN
- EXT REF 1 MIN
- EXT REF 1 MAX
10 V / 20 mA
2 V / 4 mA
0 V / 0 mA
EXT REF 1 MIN
-2%
+2%
- EXT REF 1 MIN
Hysteresis 4% of full scale

0 = KEYPAD – Defines the control panel as the reference source.

1 = AI1 – Defines analog input 1 (AI1) as the reference source.

2 = AI2 – Defines analog input 2 (AI2) as the reference source.

3 = AI1/JOYST – Defines analog input 1 (AI1), configured for joystick operation, as the reference source.
- The minimum input signal runs the drive at the maximum reference in the reverse direction. Define the minimum using parameter 1104.
- The maximum input signal runs the drive at maximum reference in the forward direction. Define the maximum using parameter 1105.
- Requires parameter 1003 = 3 (REQUEST).

WARNING! Because the low end of the reference range commands full reverse operation, do not use 0 V as the lower end of the reference range. Doing so means that if the control signal is lost (which is a 0 V input) the result is full reverse operation. Instead, use the following set-up so that loss of the analog input triggers a fault, stopping the drive:
- Set parameter 1301 MINIMUM AI1 (1304 MINIMUM AI2) at 20% (2 V or 4 mA).
- Set parameter 3021 AI1 FAULT LIMIT to a value 5% or higher.
- Set parameter 3001 AI<MIN FUNCTION to 1 (FAULT).

] Does not apply to Daikin MicroTech III applications.

4 = AI2/JOYST – Defines analog input 2 (AI2), configured for joystick operation, as the reference source.
- See above (AI1/JOYST) description.

5 = DI3U,4D(R) – Defines digital inputs as the speed reference source (motor potentiometer control).
- Digital input DI3 increases the speed (the U stands for “up”).
- Digital input DI4 decreases the speed (the D stands for “down”).
- A Stop command resets the reference to zero (the R stands for “reset”).
- Parameter 2205 ACCELER TIME 2 controls the reference signal’s rate of change. Does not apply to Daikin MicroTech III applications.

6 = DI3U,4D – Same as above (DI3U,4D(R)), except:
- A Stop command does not reset the reference to zero. The reference is stored.
- When the drive restarts, the motor ramps up (at the selected acceleration rate) to the stored reference.

7 = DI5U,6D – Same as above (DI3U,4D), except that DI5 and DI6 are the digital inputs used.

8 = COMM – Defines the fieldbus as the reference source.

9 = COMM+AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below.

10 = COMMAI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below.

11 = DI3U,4D(RNC) – Same as DI3U,4D(R) above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

12 = DI3U,4D(NC) – Same as DI3U,4D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

13 = DI5U,6D(NC) – Same as DI5U,6D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

14 = AI1+AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

15 = AI1AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

16 = AI1-AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

20 = KEYPAD(RNC) – Defines the control panel as the reference source.
- A Stop command resets the reference to zero (the R stands for reset.).
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference.

21 = KEYPAD(NC) – Defines the control panel as the reference source.
- A Stop command does not reset the reference to zero. The reference is stored.
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference.

Analog Input Reference Correction

Parameter values 9, 10 and 14…17 use the formula in the table at the right.

Value setting	Calculation of the AI reference
C + B	C value + (B value - 50% of reference value)
C * B	C value · (B value / 50% of reference value)
C - B	(C value + 50% of reference value) - B value
C / B	(C value · 50% of reference value) / B value

Where:
- C = Main reference value (= COMM for values 9, 10 and = AI1 for values 14…17).
- B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17).

Example:

The figure shows the reference source curves for value settings 9, 10 and 14…17, where:
- C = 25%.
- P 4012 SETPOINT MIN = 0.
- P 4013 SETPOINT MAX = 0.
- B varies along the horizontal axis.

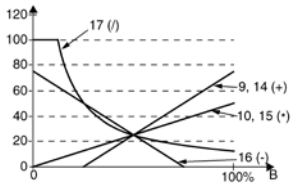
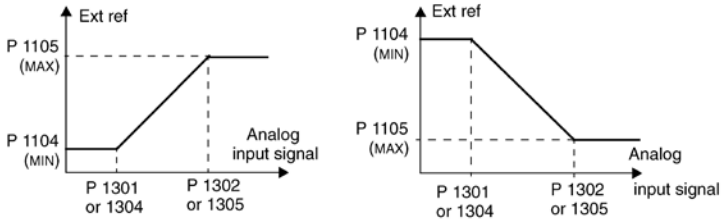
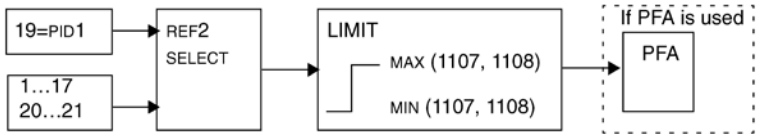


Table 9 continued: Group 11: Reference Select

1104	REF1 MIN	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm	
	Sets the minimum for external reference 1. • The minimum analog input signal (as a percent of the full signal in volts or amperes) corresponds to REF1 MIN in Hz/rpm. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. Does not apply to Daikin MicroTech III applications. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference. 				
1105	REF1 MAX	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	60.0 Hz (US) / 1800 rpm (US)	
	Sets the maximum for external reference 1. • The maximum analog input signal (as a percent of full the signal in volts or amperes) corresponds to REF1 MAX in Hz/rpm. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal. Does not apply to Daikin MicroTech III applications.				
1106	REF2 SELECT	0…17, 19…21	1	19 (PID1OUT)	☑
	Selects the signal source for external reference REF2. 0…17 – Same as for parameter 1103 REF1 SELECT. 19 = PID1OUT – The reference is taken from the PID1 output. See Group 40: PROCESS PID SET 1 and Group 41: PROCESS PID SET 2. Does not apply to Daikin MicroTech III applications. 20…21 – Same as for parameter 1103 REF1 SELECT 				

Group 12: Constant Speeds

This group defines a set of constant speeds. In general:

- You can program up to 7 constant speeds, ranging from 0…500 Hz or 0…30000 rpm.
- Values must be positive (No negative speed values for constant speeds).
- Constant speed selections are ignored if:
  - The torque control is active, or
  - The process PID reference is followed, or
  - The drive is in local control mode, or
  - PFA (Pump-Fan Alternation) is active.

Table 10: Group 12: Constant Speeds

Code	Description	Range	Resolution	Default	S
1201	CONST SPEED SEL	-14 …19	1	3 (DI3)	☑

Defines the digital inputs used to select Constant Speeds. See general comments in introduction.

0 = NOT SEL – Disables the constant speed function.

1 = DI1 – Selects Constant Speed 1 with digital input DI1.
- Digital input activated = Constant Speed 1 activated.

2…6 = DI2…DI6 – Selects Constant Speed 1 with digital input DI2…DI6. See above.

7 = DI1,2 – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
- Uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

DI1	DI2	Function
0	0	No constant speed
1	0	Constant speed 1 (1202)
0	1	Constant speed 2 (1203)
1	1	Constant speed 3 (1204)

8 = DI2,3 – Selects one of three Constant Speeds (1…3) using DI2 and DI3.
- See above (DI1,2) for code.

9 = DI3,4 – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
- See above (DI1,2) for code.

10 = DI4,5 – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
- See above (DI1,2) for code.

11 = DI5,6 – Selects one of three Constant Speeds (1…3) using DI5 and DI6.
- See above (DI1,2) for code.

12 = DI1,2,3 – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3.
- Uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

DI1	DI2	DI3	Function
0	0	0	No constant speed
1	0	0	Constant speed 1 (1202)
0	1	0	Constant speed 2 (1203)
1	1	0	Constant speed 3 (1204)
0	0	1	Constant speed 4 (1205)
1	0	1	Constant speed 5 (1206)
0	1	1	Constant speed 6 (1207)
1	1	1	Constant speed 7 (1208)
1	1	0	Constant speed 4 (1205)
0	1	0	Constant speed 5 (1206)
1	0	0	Constant speed 6 (1207)
0	0	0	Constant speed 7 (1208)

13 = DI3,4,5 – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5.
- See above (DI1,2,3) for code.

14 = DI4,5,6 – Selects one of seven Constant Speeds (1…7) using DI4, DI5 and DI6.
- See above (DI1,2,3) for code.

15…18 = TIMED FUNC 1…4 – Selects Constant Speed 1, Constant Speed 2 or the external reference, depending on the state of the Timed Function (1…4) and constant speed mode. See parameter 1209 TIMED MODE SEL and on page 35.

19 = TIMED FUN1&2 – Selects a constant speed or the external reference, depending on the state of Timed Functions 1 & 2 and constant speed mode. See parameter 1209 TIMED MODE SEL.

-1 = DI1(INV) – Selects Constant Speed 1 with digital input DI1.
- Inverse operation: Digital input de-activated = Constant Speed 1 activated.

-2…- 6 = DI2(INV)…DI6(INV) – Selects Constant Speed 1 with digital input. See above.

Table 10 continued: Group 12: Constant Speeds

Code	Description	Range	Resolution	Default	S
	-7 = DI1,2(INV) – Selects one of three Constant Speeds (1…3) using DI1 and DI2. • Inverse operation uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated): **DI1 / DI2 / Function** 1 / 1 / No constant speed 0 / 1 / Constant speed 1 (1202) 1 / 0 / Constant speed 2 (1203) 0 / 0 / Constant speed 3 (1204) -8 = DI2,3(INV) – Selects one of three Constant Speeds (1…3) using DI2 and DI3. • See above (DI1,2(INV)) for code. -9 = DI3,4(INV) – Selects one of three Constant Speeds (1…3) using DI3 and DI4. • See above (DI1,2(INV)) for code. -10 = DI4,5(INV) – Selects one of three Constant Speeds (1…3) using DI4 and DI5. • See above (DI1,2(INV)) for code. -11 = DI5,6(INV) – Selects one of three Constant Speeds (1…3) using DI5 and DI6. • See above (DI1,2(INV)) for code. -12 = DI1,2,3(INV) – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3. • Inverse operation uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated): **DI1 / DI2 / DI3 / Function** 1 / 1 / 1 / No constant speed 0 / 1 / 1 / Constant speed 1 (1202) 1 / 0 / 1 / Constant speed 2 (1203) 0 / 0 / 1 / Constant speed 3 (1204) -13 = DI3,4,5(INV) – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5. • See above (DI1,2,3(INV)) for code. -14 = DI4,5,6(INV) – Selects one of seven Constant Speeds (1…7) using DI4, DI5 and DI6. • See above (DI1,2,3(INV)) for code.				
1209	TIMED MODE SEL	1, 2	1	2 (CS1/2/3/4)	☑
	Defines timed function activated constant speed mode. Timed function can be used to change between the external reference and constant speeds when parameter 1201 CONST SPEED SEL = 15…18 (TIMED FUNC 1…4) or 19 (TIMED FUN1&2). 1 = EXT/CS1/2/3 • If parameter 1201 = 15…18 (TIMED FUNC 1…4), selects an external speed when this timed function (1…4) is not active and selects Constant speed 1 when it is active. **TIMED FUNCTION 1…4 / Function** 0 / External reference 1 / Constant speed 1 (1202) • If parameter 1201 = 19 (TIMED FUN1&2), selects an external speed when neither timed function is active, selects Constant speed 1 when only Timed function 1 is active, selects Constant speed 2 when only Timed function 2 is active and selects Constant speed 3 when both Timed functions 1 and 2 are active. **TIMED FUNCTION 1 / TIMED FUNCTION 2 / Function** 0 / 0 / External reference 1 / 0 / Constant speed 1 (1202) 0 / 1 / Constant speed 2 (1203) 1 / 1 / Constant speed 3 (1204) 2 = CS1/2/3/4 • If parameter 1201 = 15…18 (TIMED FUNC 1…4), selects Constant speed 1 when this timed function (1…4) is not active and selects Constant speed 2 when it is active. **TIMED FUNCTION 1…4 / Function** 0 / Constant speed 1 (1202) 1 / Constant speed 2 (1203) • If parameter 1201 = 19 (TIMED FUN1&2), selects Constant speed 1 when neither timed function is active, selects Constant speed 2 when only Timed function 1 is active, selects Constant speed 3 when only Timed function 2 is active and selects Constant speed 4 when both Timed functions 1 and 2 are active. **TIMED FUNCTION 1 / TIMED FUNCTION 2 / Function** 0 / 0 / Constant speed 1 (1202) 1 / 0 / Constant speed 2 (1203) 0 / 1 / Constant speed 3 (1204) 1 / 1 / Constant speed 4 (1205)				

Group 16: System Controls

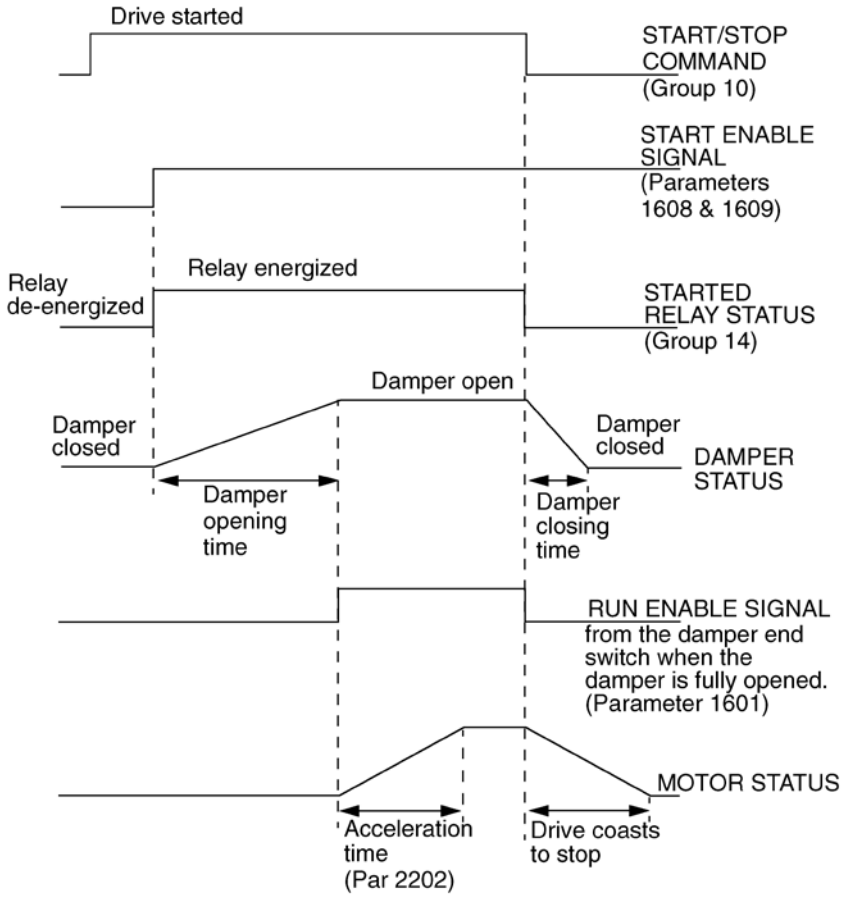
This group defines a variety of system level locks, resets and enables.

Table 11: Group 16: System Controls

Code	Description	Range	Resolution	Default	S
1601	RUN ENABLE	-6…7	1	0 (NOT SEL)	☑
	Selects the source of the run enable signal. 0 = NOT SEL – Allows the drive to start without an external run enable signal. 1 = DI1 – Defines digital input DI1 as the run enable signal. • This digital input must be activated for run enable. • If the voltage drops and de-activates this digital input, the drive will coast to stop and not start until the run enable signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the run enable signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the run enable signal. • Bit 6 of the Command Word 1 (parameter 0301) activates the run disable signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the run enable signal. • This digital input must be de-activated for run enable. • If this digital input activates, the drive will coast to stop and not start until the run enable signal resumes. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the run enable signal. • See DI1(INV) above.				
1604	FAULT RESET SEL	-6…8	1	0 (KEYPAD)	
	Selects the source for the fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 = KEYPAD – Defines the control panel as the only fault reset source. • Fault reset is always possible with control panel. 1 = DI1 – Defines digital input DI1 as a fault reset source. • Activating the digital input resets the drive. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as a fault reset source. • See DI1 above. 7 = START/STOP – Defines the Stop command as a fault reset source. • Do not use this option when fieldbus communication provides the start, stop and direction commands. 8 = COMM – Defines the fieldbus as a fault reset source. • The Command Word is supplied through fieldbus communication. • The bit 4 of the Command Word 1 (parameter 0301) resets the drive. -1 = DI1(INV) – Defines an inverted digital input DI1 as a fault reset source. • De-activating the digital input resets the drive. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as a fault reset source. • See DI1(INV) above.				
1607	PARAM. SAVE	0, 1	1	0 (DONE)	
	Saves all altered parameters to permanent memory. • Parameters altered through a fieldbus are not automatically saved to permanent memory. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 2 (NOT SAVED), parameters altered from the control panel are not saved. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 1 (OPEN), parameters altered from the control panel are stored immediately to permanent memory. 0 = DONE – Value changes automatically when all parameters are saved. 1 = SAVE… – Saves altered parameters to permanent memory.				

Table 11 continued: Group 16: System Controls

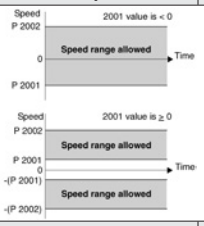
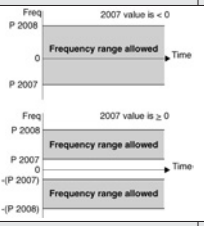
1608	START ENABLE 1	-6…7	1	4 (DI4)	☑
	Selects the source of the start enable 1 signal. Note: Start enable functionality differs from the run enable functionality. 0 = NOT SEL – Allows the drive to start without an external start enable signal. 1 = DI1 – Defines digital input DI1 as the start enable 1 signal. • This digital input must be activated for start enable 1 signal. • If the voltage drops and de-activates this digital input, the drive will coast to stop and show alarm 2021 on the panel display. The drive will not start until start enable 1 signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the start enable 1 signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the start enable 1 signal. • Bit 2 of the Command Word 2 (parameter 0302) activates the start disable 1 signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the start enable 1 signal. -2…-6 = DI2 (INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the start enable 1 signal. • See DI1 (INV) above.				
1611	PARAMETER VIEW	0, 1	1	0 (DEFAULT)	
	Selects the parameter view, i.e. which parameters are shown. **Note:** This parameter is visible only when it is activated by the optional FlashDrop device. FlashDrop is designed for fast copying of parameters to unpowered drives. It allows easy customization of the parameter list, e.g. selected parameters can be hidden. For more information, see MFDT-01 FlashDrop User's Manual (3AFE68591074 [English]). FlashDrop parameter values are activated by setting parameter 9902 to 31 (LOAD FD SET). 0 = DEFAULT – Complete long and short parameter lists are shown. 1 = FLASHDROP – FlashDrop parameter list is shown. Does not include short parameter list. Parameters that are hidden by the FlashDrop device are not visible.				



Group 20: Limits

This group defines minimum and maximum limits to follow in driving the motor –speed, frequency, current, torque, etc.

Table 12: Group 20 — Limits

Code	Name	Range	Resolution	Default	User	S
2001	**MINIMUM SPEED**	**-30000…30000 rpm**	**1 rpm**	**0 rpm**		☑
	Defines the minimum speed (rpm) allowed. • A positive (or zero) minimum speed value defines two ranges, one positive and one negative. • A negative minimum speed value defines one speed range. • See the figure.					
2002	**MAXIMUM SPEED**	**0…30000 rpm**	**1 rpm**	**1800 rpm (US)**		☑
	Defines the maximum speed (rpm) allowed.					
2003	**MAX CURRENT**	**0… 1.3 · $I2_n$**	**0.1 A**	**1.3 · $I2_n$**		☑
	Defines the maximum output current (A) supplied by the drive to the motor.					
2006	**UNDERVOLT CTRL**	**0…2**	**1**	**1 [ENABLE(TIME)]**		
	Sets the DC undervoltage controller on or off. When on: • If the DC bus voltage drops due to loss of input power, the undervoltage controller decreases the motor speed in order to keep the DC bus voltage above the lower limit. • When the motor speed decreases, the inertia of the load causes regeneration back into the drive, keeping the DC bus charged and preventing an undervoltage trip. • The DC undervoltage controller increases power loss ride-through on systems with a high inertia, such as a centrifuge or a fan. 0 = DISABLE – Disables controller. 1 = ENABLE(TIME) – Enables controller with 500 ms time limit for operation. 2 = ENABLE – Enables controller without maximum time limit for operation.					
2007	**MINIMUM FREQ**	**-500.0…500.0 Hz**	**0.1 Hz**	**0.0 Hz**		☑
	Defines the minimum limit for the drive output frequency. • A positive or zero minimum frequency value defines two ranges, one positive and one negative. • A negative minimum frequency value defines one speed range. See the figure. **Note:** Keep MINIMUM FREQ ≤ MAXIMUM FREQ.					
2008	**MAXIMUM FREQ**	**0.0…500.0 Hz**	**0.1 Hz**	**60.0 Hz (US)**		☑
	Defines the maximum limit for the drive output frequency.					
2013	**MIN TORQUE SEL**	**-6…7**	**1**	**0 (MIN TORQUE 1)**		
	Defines control of the selection between two minimum torque limits (2015 MIN TORQUE 1 and 2016 MIN TORQUE 2). 0 = MIN TORQUE 1 – Selects 2015 MIN TORQUE 1 as the minimum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 2 value. • De-activating the digital input selects MIN TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the minimum limit used. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 1 value. • De-activating the digital input selects MIN TORQUE 2 value. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1(INV) above.					
2014	**MAX TORQUE SEL**	**-6…7**	**1**	**0 (MAX TORQUE 1)**		
	Defines control of the selection between two maximum torque limits (2017 MAX TORQUE 1 and 2018 MAX TORQUE 2). 0 = MAX TORQUE 1 – Selects 2017 MAX TORQUE 1 as the maximum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the maximum limit used. • Activating the digital input selects MAX TORQUE 2 value. • De-activating the digital input selects MAX TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the maximum limit used. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines an inverted digital input di1 as the control for selecting the maximum limit used. • Activating the digital input selects MAX TORQUE 1 value. • De-activating the digital input selects MAX TORQUE 2 value. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1(INV) above					

Group 21: Start/Stop

This group defines how the motor starts and stops. The MD5 supports several start and stop modes.

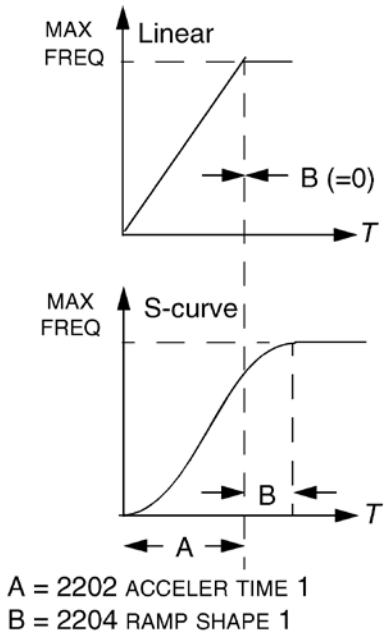
Table 13: Group 21: Start/Stop

Code	Description	Range	Resolution	Default	S
2101	START FUNCTION	Vector control modes: 1, 2, 8 Scalar control mode: 1…5, 8	1	3 (SCALAR FLYST)	☑
	Selects the motor start method. The valid options depend on the value of parameter 9904 MOTOR CTRL MODE. Does not apply to Daikin MicroTech III applications. 1 = AUTO – Selects the automatic start mode. • Vector control modes: Optimal start in most cases. The drive automatically selects the correct output frequency to start a rotating motor. • SCALAR:FREQ mode: Immediate start from zero frequency. Identical to selection 8 = RAMP. 2 = DC MAGN – Selects the DC Magnetizing start mode. **Note:** The DC Magnetizing start mode cannot start a rotating motor. **Note:** The drive starts when the set pre-magnetizing time (parameter 2103 DC MAGN TIME) has passed, even if motor magnetization is not complete. • Vector control modes: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. This selection guarantees the highest possible break-away torque. • SCALAR:FREQ mode: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. 3 = SCALAR FLYST – Selects the flying start mode. • Vector control modes: Not applicable. • SCALAR:FREQ mode: The drive automatically selects the correct output frequency to start a rotating motor – useful if the motor is already rotating and if the drive will start smoothly at the current frequency. • Cannot be used in multimotor systems. 4 = TORQ BOOST – Selects the automatic torque boost mode (SCALAR:FREQ mode only). • May be necessary in drives with high starting torque. • Torque boost is only applied at start, ending when output frequency exceeds 20 Hz or when output frequency is equal to reference. • In the beginning the motor magnetizes within the time determined by the parameter 2103 DC MAGN TIME using DC current. • See parameter 2110 TORQ BOOST CURR. Does not apply to Daikin MicroTech III applications. 5 = FLY + BOOST – Selects both the flying start and the torque boost mode (SCALAR:FREQ mode only). • Flying start routine is performed first and the motor is magnetized. If the speed is found to be zero, the torque boost is done. 8 = RAMP – Immediate start from zero frequency.				
2102	**STOP FUNCTION**	**1, 2**	**1**	**1 (COAST)**	
	Selects the motor stop method. 1 = COAST – Selects cutting off the motor power as the stop method. The motor coasts to stop. 2 = RAMP – Selects using a deceleration ramp. • Deceleration ramp is defined by 2203 DECELER TIME 1 or 2206 DECELER TIME 2 (whichever is active).				
2103	DC MAGN TIME	0.00…10.00 s	0.01 s	0.30 s	
	Defines the pre-magnetizing time for the DC Magnetizing start mode. • Use parameter 2101 to select the start mode. • After the start command, the drive pre-magnetizes the motor for the time defined here and then starts the motor. • Set the pre-magnetizing time just long enough to allow full motor magnetization. Too long a time heats the motor excessively.				

Group 22: Accel/Decel

This group defines ramps that control the rate of acceleration and deceleration. You define these ramps as a pair, one for acceleration and one for deceleration. You can define two pairs of ramps and use a digital input to select one or the other pair.

Table 14: Group 22: Accel/Decel

Code	Description	Range	Resolution	Default	S
2202	ACCELER TIME 1	0.0… 1800.0 s	0.1 s	30.0 s	
	Sets the acceleration time for zero to maximum frequency for ramp pair 1. See A in the figure. • Actual acceleration time also depends on 2204 RAMP SHAPE 1. • See 2008 MAXIMUM FREQ, page 28. 				
2203	DECELER TIME 1	0.0… 1800.0 s	0.1 s	30.0 s	
	Sets the deceleration time for maximum frequency to zero for ramp pair 1. • Actual deceleration time also depends on 2204 RAMP SHAPE 1. • See 2008 MAXIMUM FREQ, page 28.				

Group 26: Motor Control

This group defines variables used for motor control.

Table 15: Group 26: Motor Control

Code	Description	Range	Resolution	Default	S
2605	U/f RATIO	1, 2	1	2 (SQUARED)	
	Selects the form for the U/f (voltage to frequency) ratio below field weakening point. 1 = LINEAR – Preferred for constant torque applications. 2 = SQUARED – Preferred for centrifugal pump and fan applications. (SQUARED is more silent for most operating frequencies.)				

Group 30: Fault Functions

This group defines situations that the drive should recognize as potential faults and defines how the drive should respond if the fault is detected.

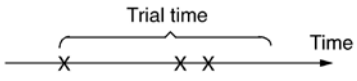
Table 16: Group 30: Fault Functions

Code	Description	Range	Resolution	Default	S
3003	EXTERNAL FAULT 1	-6…6	1	0 (NOT SEL)	
	Defines the External Fault 1 signal input and the drive response to an external fault. 0 = NOT SEL – External fault signal is not used. 1 = DI1 – Defines digital input DI1 as the external fault input. • Activating the digital input indicates a fault. The drive displays a fault (14, EXT FAULT 1) and the drive coasts to stop. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the external fault input. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the external fault input. • De-activating the digital input indicates a fault. The drive displays a fault (14, EXT FAULT 1) and the drive coasts to stop. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the external fault input. • See DI1(INV) above.				

Group 31: Automatic Reset

This group defines conditions for automatic resets. An automatic reset occurs after a particular fault is detected. The drive holds for a set delay time, then automatically restarts. You can limit the number of resets in a specified time period and set up automatic resets for a variety of faults.

Table 17: Group 31: Automatic Reset

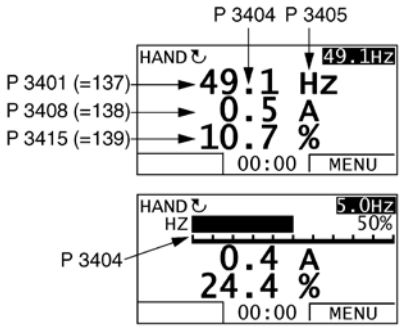
Code	Description	Range	Resolution	Default	S
3101	NUMBER OF TRIALS	0…5	1	5	
	Sets the number of allowed automatic resets within a trial period defined by 3102 TRIAL TIME. • If the number of automatic resets exceeds this limit (within the trial time), the drive prevents additional automatic resets and remains stopped. • Starting then requires a successful reset performed from the control panel or from a source selected by 1604 FAULT RESET SEL. **Example:** Three faults have occurred in the trial time. The last is reset only if the value for 3101 NUMBER OF TRIALS is 3 or more. 				
3102	TRIAL TIME	1.0…600.0 s	0.1 s	30.0 s	
	Sets the time period used for counting and limiting the number of resets. • See 3101 NUMBER OF TRIALS.				
3103	DELAY TIME	0.0… 120.0 s	0.1 s	6.0 s	
	Sets the delay time between a fault detection and attempted drive restart. • If DELAY TIME = zero, the drive resets immediately.				
3104	AR OVERCURRENT	0, 1	1	0 (DISABLE)	
	Sets the automatic reset for the overcurrent function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (OVERCURRENT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.				

Group 34: Panel Display

This group defines the content for control panel display (middle area), when the control panel is in the Output mode.

Table 18: Group 34: Panel Display

Code	Description	Range	Resolution	Default	S
3401	SIGNAL1 PARAM	100…178	1	103 (OUTPUT FREQ)	
	Selects the first parameter (by number) displayed on the control panel. • Definitions in this group define display content when the control panel is in the control mode. • Any parameter number in Group 01: OPERATING DATA can be selected. • Using the following parameters, the display value can be scaled, converted to convenient units and/or displayed as a bar graph. • The figure identifies selections made by parameters in this group. • If just one or two parameters are selected for display, that is just one or two of the values of parameters 3401 SIGNAL1 PARAM, 3408 SIGNAL2 PARAM and 3415 SIGNAL3 PARAM are other than 100 (NOT SELECTED), the number and name of each displayed parameter are shown in addition to the value. 100 = NOT SELECTED – First parameter not displayed. 101…178 – Displays parameter 0101…0178. If parameter does not exist, the display shows “n.a.”.				
3404	OUTPUT1 DSP FORM	0…9	1	5 (+0.0)	
	Defines the decimal point location for the first display parameter. 0…7 – Defines the decimal point location. • Enter the number of digits desired to the right of the decimal point. • See the table for an example using pi (3.14159). 8 = BAR METER – Specifies a bar meter display. 9 = DIRECT – Decimal point location and units of measure are identical to the source signal. See Group 01: Operating Data on page 13 parameter listing in section Complete parameter list on page 1-67 for resolution (which indicates the decimal point location) and the units of measure.				
3405	OUTPUT1 UNIT	0…127	1	121 (%SP)	
	Selects the units used with the first display parameter. **Note:** Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).				



3404 value	Display	Range
0	± 3.0	-32768…+32767 (Signed)
1	± 3.1	
2	± 3.14	
3	± 3.142	
4	3.0	0…65535 (Unsigned)
5	3.1	
6	3.14	
7	3.142	
8	Bar meter displayed.	
9	Decimal point location and units as for the source signal.	

0 = NO UNIT	9 = °C	18 = MWh	27 = ft	36 = l/s	45 = Pa	54 = lb/m	63 = Mrev
1 = A	10 = lb ft	19 = m/s	28 = MGD	37 = l/min	46 = GPS	55 = lb/h	64 = d
2 = V	11 = mA	20 = m3/h	29 = inHg	38 = l/h	47 = gal/s	56 = FPS	65 = inWC
3 = Hz	12 = mV	21 = dm3/s	30 = FPM	39 = m3/s	48 = gal/m	57 = ft/s	66 = m/min
4 = %	13 = kW	22 = bar	31 = kb/s	40 = m3/m	49 = gal/h	58 = inH2O	67 = Nm
5 = s	14 = W	23 = kPa	32 = kHz	41 = kg/s	50 = ft3/s	59 = in wg	68 = Km3/h
6 = h	15 = kWh	24 = GPM	33 = ohm	42 = kg/m	51 = ft3/m	60 = ft wg	
7 = rpm	16 = °F	25 = PSI	34 = ppm	43 = kg/h	52 = ft3/h	61 = lbsi	
8 = kh	17 = hp	26 = CFM	35 = pps	44 = mbar	53 = lb/s	62 = ms	

The following units are useful for the bar display.

117 = %ref	119 = %dev	121 = % SP	123 = Iout	125 = Fout	127 = Vdc
118 = %act	120 = %LD	122 = %FBK	124 = Vout	126 = Tout	

Table 18 continued: Group 34: Panel Display

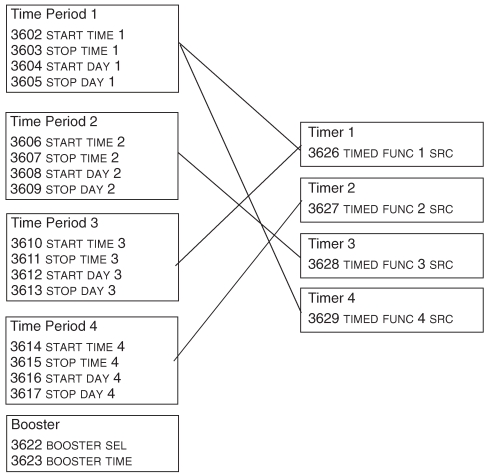
3407	OUTPUT1 MAX	Depends on selection	—	1000.0 (%SP)	
	Sets the maximum value displayed for the first display parameter. **Note:** Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).				
3408	SIGNAL 2 PARAM	100…178	1	104	
	Selects the second parameter (by number) displayed on the control panel. See parameter 3401.				
3415	SIGNAL3 PARAM	100…178	1	120 (AI 1)	
	Selects the third parameter (by number) displayed on the control panel. See parameter 3401.				
3418	OUTPUT3 DSP FORM	0…9	1	5 (+0.0)	
	Defines the decimal point location for the third display parameter. See parameter 3404.				
3420	OUTPUT3 MIN	Depends on selection	—	0.0 mA	
3421	OUTPUT3 MAX	Depends on selection	—	20.0 mA	
	Sets the maximum value displayed for the third display parameter. See parameter 3407.				

Group 36: Timed Functions

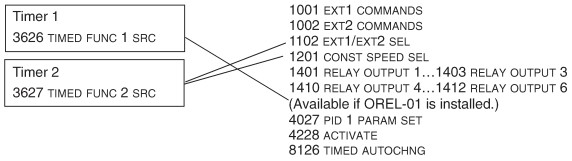
This group defines the timed functions. The timed functions include:

- Four daily start and stop times
- Four weekly start, stop and boost times
- Four timers for collecting selected periods together.

A timer can be connected to multiple time periods and a time period can be in multiple timers.



A parameter can be connected to only one timer..


Timer 1
3626 TIMED FUNC 1 SRC
Timer 2
3627 TIMED FUNC 2 SRC
1001 EXT1 COMMANDS
1002 EXT2 COMMANDS
1102 EXT1/EXT2 SEL
1201 CONST SPEED SEL
1401 RELAY OUTPUT 1…1403 RELAY OUTPUT 3
1410 RELAY OUTPUT 4…1412 RELAY OUTPUT 6
(Available if OREL-01 is installed.)
4027 PID 1 PARAM SET
4228 ACTIVATE
8126 TIMED AUTOCHNG

You can use the Timed functions assistant for easy configuring.

Table 19: Group 36: Timed Functions

Code	Description	Range	Resolution	Default	S
3601	TIMERS ENABLE	-6…7	1	0 (NOT SEL)	
	Selects the source for the timer enable signal. 0 = NOT SEL – Timed functions are disabled. 1 = DI1 – Defines digital input DI1 as the timed function enable signal. • The digital input must be activated to enable the timed function. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the timed function enable signal. 7 = ACTIVE – Timed functions are enabled. -1 = DI1(INV) – Defines an inverted digital input DI1 as the timed function enable signal. • This digital input must be de-activated to enable the timed function. • -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the timed function enable signal.				
3602	START TIME 1	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines the daily start time. • The time can be changed in steps of 2 seconds. • If parameter value is 07:00:00, the timer is activated at 7 a.m. • The figure shows multiple timers on different weekdays.				

Table 19 continued: Group 36: Timed Functions

3603	STOP TIME 1	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines the daily stop time. • The time can be changed in steps of 2 seconds. • If the parameter value is 09:00:00, the timer is deactivated at 9 a.m.				
3604	START DAY 1	1…7	1	1 (MONDAY)	
	Defines the weekly start day. 1 = MONDAY…7 = SUNDAY • If parameter value is 1, timer 1 weekly is active from Monday midnight (00:00:00).				
3605	STOP DAY 1	1…7	1	1 (MONDAY)	
	Defines weekly stop day. 1 = MONDAY…7 = SUNDAY • If parameter value is 5, timer 1 weekly is deactivated on Friday midnight (23:59:58).				
3606	START TIME 2	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer2 daily start time. • See parameter 3602.				
3607	STOP TIME 2	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer 2 daily stop time. • See parameter 3603.				
3608	START DAY 2	1…7	1	1 (MONDAY)	
	Defines timer 2 weekly start day. • See parameter 3604.				
3609	STOP DAY 2	1…7	1	1 (MONDAY)	
	Defines timer 2 weekly stop day. • See parameter 3605.				
3610	START TIME 3	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer 3 daily start time. • See parameter 3602.				
3611	STOP TIME 3	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer 3 daily stop time. • See parameter 3603.				
3612	START DAY 3	1…7	1	1 (MONDAY)	
	Defines timer 3 weekly start day. • See parameter 3604.				
3613	STOP DAY 3	1…7	1	1 (MONDAY)	
	Defines timer 3 weekly stop day. • See parameter 3605.				
3614	START TIME 4	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer 4 daily start time. • See parameter 3602.				
3615	STOP TIME 4	00:00:00…23:59:58	2 s	12:00:00 AM	
	Defines timer 4 daily stop time. • See parameter 3603.				
3616	START DAY 4	1…7	1	1 (MONDAY)	
	Defines timer 4 weekly start day. • See parameter 3604.				
3617	STOP DAY 4	1…7	1	1 (MONDAY)	
	Defines timer 4 weekly stop day. • See parameter 3605.				
3622	BOOSTER SEL	-6…6	1	0 (NOT SEL)	
	Selects the source for the booster signal. 0 = NOT SEL – Booster signal is disabled. 1 = DI1 – Defines DI1 as the booster signal. 2…6 = DI2…DI6 – Defines DI2…DI6 as the booster signal. -1 = DI1(INV) – Defines an inverted digital input DI1 as the booster signal. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the booster signal.				
3623	BOOSTER TIME	00:00:00…23:59:58	2 s	00:00:00	
	Defines the booster ON time. Time is started when booster sel signal is released. If parameter value is 01:30:00, booster is active for 1 hour and 30 minutes after activation DI is released.				

Group 53: EFB Protocol

This group defines set-up variables used for an embedded fieldbus (EFB) communication protocol. The standard EFB protocol in the MD5 is Modbus. See chapter Embedded Fieldbus on page 45.

Table 20: Group 53: EFB Protocol

Code	Description	Range	Resolution	Default	S
5302	EFB STATION ID	0…65535	1 = SAF 2 = RAF/EAF 3 = ERW	1	☑
	Defines the node address of the RS485 link. • The node address on each unit must be unique.				
5303	EFB BAUD RATE	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 76.8 kb/s	—	9.6 kb/s	
	Defines the communication speed of the RS485 link in kbits per second (kb/s). 1.2 kb/s 2.4 kb/s 4.8 kb/s 9.6 kb/s 19.2 kb/s 38.4 kb/s 57.6 kb/s 76.8 kb/s				
5304	EFB PARITY	0…3	1	0 (8 NONE 1)	
	Defines the data length, parity and stop bits to be used with the RS485 link communication. • The same settings must be used in all on-line stations. 0 = 8 NONE 1 – 8 data bits, no parity, one stop bit. 1 = 8 NONE 2 – 8 data bits, no parity, two stop bits. 2 = 8 EVEN 1 – 8 data bits, even parity, one stop bit. 3 = 8 ODD 1 – 8 data bits, odd parity, one stop bit.				
5306	EFB OK MESSAGES	0…65535	1	0	
	Contains a count of valid messages received by the drive. • During normal operation, this counter is increasing constantly.				
5307	EFB CRC ERRORS	0…65535	1	0	
	Contains a count of the messages with a CRC error received by the drive. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.				
5308	EFB UART ERRORS	0…65535	1	0	
	Contains a count of the messages with a character error received by the drive.				
5309	EFB STATUS	0…7	1	0 (IDLE)	
	Contains the status of the EFB protocol. 0 = IDLE – EFB protocol is configured, but not receiving any messages. 1 = EXECUT INIT – EFB protocol is initializing. 2 = TIME OUT – A timeout has occurred in the communication between the network master and the EFB protocol. 3 = CONFIG ERROR – EFB protocol has a configuration error. 4 = OFF-LINE – EFB protocol is receiving messages that are NOT addressed to this drive. 5 = ON-LINE – EFB protocol is receiving messages that are addressed to this drive. 6 = RESET – EFB protocol is performing a hardware reset. 7 = LISTEN ONLY – EFB protocol is in listen-only mode.				
5311	EFB PAR 11	0…65535	1	0	
	Specifies the parameter mapped to Modbus Register 40006.				
5312	EFB PAR 12	0…65535	1	0	
	Specifies the parameter mapped to Modbus Register 40007.				
5313	EFB PAR 13	0…65535	1	0	
	Specifies the parameter mapped to Modbus Register 40008.				

Group 64: Load Analyzer

This group defines the load analyzer, which can be used for analyzing the customer's process and sizing the drive and the motor.

The peak value is logged at 2 ms level, and the distribution loggers are updated on 0.2 s (200 ms) time level. Three different values can be logged.

1. Amplitude logger 1: The measured current is logged continuously. The distribution as a percentage of the nominal current $I2_n$ is shown in ten classes.
2. Peak value logger: One signal in group 1 can be logged for the peak (maximum) value. The peak value of the signal, peak time (time when the peak value was detected) as well the frequency, current and DC voltage at the peak time are shown.
3. Amplitude logger 2: One signal in group 1 can be logged for amplitude distribution. The base value (100% value) can be set by the user.

The first logger cannot be reset. The other two loggers can be reset by a user defined method. They are also reset if either of the signals or the peak value filter time is changed.

Table 21: Group 64: Load Analyzer

Code	Description	Range	Resolution	Default	S
6401	PVL SIGNAL	100…178	1	103 (OUTPUT FREQ)	
	Defines (by number) the signal logged for the peak value. • Any parameter number in Group 01: Operating Data on page 13 can be selected. Eg 102 = parameter 0102 SPEED. 100 = NOT SELECTED – No signal (parameter) logged for the peak value. 101…178 – Logs parameter 0101…0178.				
6402	PVL FILTER TIME	0.0…120.0 s	0.1 s	0.1 s	
	Defines the filter time for peak value logging. • 0.0…120.0 – Filter time (seconds).				
6403	LOGGERS RESET	-6…7	1	0 (NOT SEL)	
	Defines the source for the reset of peak value logger and amplitude logger 2. 0 = NOT SEL – No reset selected. 1 = DI1 – Reset loggers on the rising edge of digital input DI1. 2…6 = DI2…DI6 – Reset loggers on the rising edge of digital input DI2…DI6. 7 = RESET – Reset loggers. Parameter is set to NOT SEL. -1 = DI1(INV) – Reset loggers on the falling edge of digital input DI1. -2…-6 = DI2(INV) …DI6(INV) – Reset loggers on the falling edge of digital input DI2…DI6.				
6404	AL2 SIGNAL	101…178	1	103 (OUTPUT FREQ)	
	Defines the signal logged for amplitude logger 2. • Any parameter number in Group 01: Operating Data can be selected. Eg 102 = parameter 0102 SPEED. 100 = NOT SELECTED – No signal (parameter) logged for amplitude distribution (amplitude logger 2). 101…178 – Logs parameter 0101…0178.				
6405	AL2 SIGNAL BASE	Depends on selection	—	60.0 Hz	
	Defines the base value from which the percentage distribution is calculated. • Representation and default value depends on the signal selected with parameter 6404 AL2 SIGNAL.				
6406	PEAK VALUE	—	—	—	
	Detected peak value of the signal selected with parameter 6401 PVL SIGNAL.				
6407	PEAK TIME 1	Date dd.mm.yy / power-on time in days	1 d	—	
	Date of the peak value detection. • Format: Date if the real time clock is operating (dd.mm.yy). / The number of days elapsed after the power-on if the real time clock is not used, or was not set (xx d).				
6408	PEAK TIME 2	Time hh.mm.ss	2 s	—	
	Time of the peak value detection. • Format: hours:minutes:seconds.				
6409	CURRENT AT PEAK	0.0…6553.5 A	0.1 A	—	
	Current at the moment of the peak value (amperes).				
6410	UDC AT PEAK	0…65535 V	1 V	—	
	DC voltage at the moment of the peak value (volts).				

Table 21 continued: Group 64: Load Analyzer

6411	FREQ AT PEAK	0.0…6553.5 Hz	0.1 Hz	—	
	Output frequency at the moment of the peak value (herzes).				
6412	TIME OF RESET 1	Date dd.mm.yy / power-on time in days	1 d	—	
	Last reset date of the peak logger and amplitude logger 2. • Format: Date if the real time clock is operating (dd.mm.yy). / The number of days elapsed after the power-on if the real time clock is not used, or was not set (xx d).				
6413	TIME OF RESET 2	Time hh.mm.ss	2 s	—	
	Last reset time of the peak logger and amplitude logger 2. • Format: hours:minutes:seconds.				
6414	AL1RANGE0TO10	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 0…10% distribution.				
6415	AL1RANGE10TO20	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 10…20% distribution.				
6416	AL1RANGE20TO30	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 20…30% distribution.				
6417	AL1RANGE30TO40	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 30…40% distribution.				
6418	AL1RANGE40TO50	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 40…50% distribution.				
6419	AL1RANGE50TO60	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 50…60% distribution.				
6420	AL1RANGE60TO70	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 60…70% distribution.				
6421	AL1RANGE70TO80	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 70…80% distribution.				
6422	AL1RANGE80TO90	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) 80…90% distribution.				
6423	AL1RANGE90TO	0.0…100.0%	0.1%	—	
	Amplitude logger 1 (current in percent of nominal current $I2_n$) over 90% distribution.				
6424	AL2RANGE0TO10	0.0…100.0%	0.1%	—	
	Amplitude logger 2 (signal selection with parameter 6404) 0…10% distribution.				
6425	AL2RANGE10TO20	0.0…100.0%	0.1%	—	
	Amplitude logger 2 (signal selection with parameter 6404) 10…20% distribution.				
6426	AL2RANGE20TO30	0.0…100.0%	0.1%	—	
	Amplitude logger 2 (signal selection with parameter 6404) 20…30% distribution.				

Group 81: PFA Control

Table 22: Group 81: PFA Control

<table>
<tr><th>Code</th><th>Description</th><th>Range</th><th>Resolution</th><th>Default</th><th>S</th></tr>
<tr><td>8120</td><td>INTERLOCKS</td><td>0…6</td><td>1</td><td>4 (DI4)</td><td>☑</td></tr>
<tr><td></td><td colspan="5">
Defines operation of the Interlock function. When the Interlock function is enabled:
• An interlock is active when its command signal is absent.
• An interlock is inactive when its command signal is present.
• The MD5 will not start if a start command occurs when the speed regulated motor’s interlock is active – the control panel displays an alarm.
Wire each Interlock circuit as follows:
• Wire a contact of the motor’s On/Off switch to the Interlock circuit – the drive’s PFA logic can then recognize that the motor is switched off and start the next available motor.
• Wire a contact of the motor thermal relay (or other protective device in the motor circuit) to the Interlock input – the drive’s PFA logic can then recognize that a motor fault is activated and stop the motor.
0 = NOT SEL – Disables the Interlock function. All digital inputs are available for other purposes.
• Requires 8118 AUTOCHNG INTERV = 0.0 (The Autochange function must be disabled if Interlock function is disabled.)
1 = DI1 – Enables the Interlock function and assigns a digital input (starting with DI1) to the interlock signal for each PFA relay. These assignments are defined in the following table and depend on:
• the number of PFA relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFA)]
• the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).
<table>
<tr><th>No. PFA relays</th><th>Autochange disabled (P 8118)</th><th>Autochange enabled (P 8118)</th></tr>
<tr><td>0</td><td>DI1: Speed Reg Motor
DI2…DI6: Free</td><td>Not allowed</td></tr>
<tr><td>1</td><td>DI1: Speed Reg Motor
DI2: First PFA Relay
DI3…DI6: Free</td><td>DI1: First PFA Relay
DI2…DI6: Free</td></tr>
<tr><td>2</td><td>DI1: Speed Reg Motor
DI2: First PFA Relay
DI3: Second PFA Relay
DI4…DI6: Free</td><td>DI1: First PFA Relay
DI2: Second PFA Relay
DI3…DI6: Free</td></tr>
<tr><td>3</td><td>DI1: Speed Reg Motor
DI2: First PFA Relay
DI3: Second PFA Relay
DI4: Third PFA Relay
DI5…DI6: Free</td><td>DI1: First PFA Relay
DI2: Second PFA Relay
DI3: Third PFA Relay
DI4…DI6: Free</td></tr>
<tr><td>4</td><td>DI1: Speed Reg Motor
DI2: First PFA Relay
DI3: Second PFA Relay
DI4: Third PFA Relay
DI5: Fourth PFA Relay
DI6: Free</td><td>DI1: First PFA Relay
DI2: Second PFA Relay
DI3: Third PFA Relay
DI4: Fourth PFA Relay
DI5…DI6: Free</td></tr>
<tr><td>5</td><td>DI1: Speed Reg Motor
DI2: First PFA Relay
DI3: Second PFA Relay
DI4: Third PFA Relay
DI5: Fourth PFA Relay
DI6: Fifth PFA Relay</td><td>DI1: First PFA Relay
DI2: Second PFA Relay
DI3: Third PFA Relay
DI4: Fourth PFA Relay
DI5: Fifth PFA Relay
DI6: Free</td></tr>
<tr><td>6</td><td>Not allowed</td><td>DI1: First PFA Relay
DI2: Second PFA Relay
DI3: Third PFA Relay
DI4: Fourth PFA Relay
DI5: Fifth PFA Relay
DI6: Sixth PFA Relay</td></tr>
</table>
</td></tr>
</table>

Table 22 continued: Group 81: PFA Control

2 = DI2 – Enables the Interlock function and assigns a digital input (starting with DI2) to the interlock signal for each PFA relay. These assignments are defined in the following table and depend on:
- the number of PFA relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFA)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFA relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1: Free DI2: Speed Reg Motor DI3…DI6: Free	Not allowed
1	DI1: Free DI2: Speed Reg Motor DI3: First PFA Relay DI4…DI6: Free	DI1: Free DI2: First PFA Relay DI3…DI6: Free
2	DI1: Free DI2: Speed Reg Motor DI3: First PFA Relay DI4: Second PFA Relay DI5…DI6: Free	DI1: Free DI2: First PFA Relay DI3: Second PFA Relay DI4…DI6: Free
3	DI1: Free DI2: Speed Reg Motor DI3: First PFA Relay DI4: Second PFA Relay DI5: Third PFA Relay DI6: Free	DI1: Free DI2: First PFA Relay DI3: Second PFA Relay DI4: Third PFA Relay DI5…DI6: Free
4	DI1: Free DI2: Speed Reg Motor DI3: First PFA Relay DI4: Second PFA Relay DI5: Third PFA Relay DI6: Fourth PFA Relay DI1: Free	DI2: First PFA Relay DI3: Second PFA Relay DI4: Third PFA Relay DI5: Fourth PFA Relay DI6: Free
5	Not allowed	DI1: Free DI2: First PFA Relay DI3: Second PFA Relay DI4: Third PFA Relay DI5: Fourth PFA Relay DI6: Fifth PFA Relay
6	Not allowed	Not allowed

3 = DI3 – Enables the Interlocks function and assigns a digital input (starting with DI3) to the interlock signal for each PFA relay. These assignments are defined in the following table and depend on:
- the number of PFA relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFA)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFA relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1…DI2: Free DI3: Speed Reg Motor DI4…DI6: Free	Not allowed
1	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFA Relay DI5…DI6: Free	DI1…DI2: Free DI3: First PFA Relay DI4…DI6: Free
2	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFA Relay DI5: Second PFA Relay DI6: Free	DI1…DI2: Free DI3: First PFA Relay DI4: Second PFA Relay DI5…DI6: Free
3	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFA Relay DI5: Second PFA Relay DI6: Third PFA Relay DI1…DI2: Free	DI3: First PFA Relay DI4: Second PFA Relay DI5: Third PFA Relay DI6: Free
4	Not allowed	DI1…DI2: Free DI3: First PFA Relay DI4: Second PFA Relay DI5: Third PFA Relay DI6: Fourth PFA Relay
5…6	Not allowed	Not allowed

Table 22 continued: Group 81: PFA Control

4 = DI4 – Enables the Interlock function and assigns a digital input (starting with DI4) to the interlock signal for each PFA relay. These assignments are defined in the following table and depend on:
- the number of PFA relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFA)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFA relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1…DI3: Free DI4: Speed Reg Motor DI5…DI6: Free	Not allowed
1	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFA Relay DI6: Free	DI1…DI3: Free DI4: First PFA Relay DI5…DI6: Free
2	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFA Relay DI6: Second PFA Relay DI1…DI3: Free	DI4: First PFA Relay DI5: Second PFA Relay DI6: Free
3	Not allowed	DI1…DI3: Free DI4: First PFA Relay DI5: Second PFA Relay DI6: Third PFA Relay
4…6	Not allowed	Not allowed

5 = DI5 – Enables the Interlock function and assigns a digital input (starting with DI5) to the interlock signal for each PFA relay. These assignments are defined in the following table and depend on:
- the number of PFA relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFA)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFA relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1…DI4: Free DI5: Speed Reg Motor DI6: Free	Not allowed
1	DI1…DI4: Free DI5: Speed Reg Motor DI6: First PFA Relay	DI1…DI4: Free DI5: First PFA Relay DI6: Free
2	Not allowed	DI1…DI4: Free DI5: First PFA Relay DI6: Second PFA Relay
3…6	Not allowed	Not allowed

6 = DI6 – Enables the Interlock function and assigns digital input DI6 to the interlock signal for the speed regulated motor.
- Requires 8118 AUTOCHNG INTERV = 0.0.

No. PFA relays	Autochange disabled	Autochange enabled
0	DI1…DI5: Free DI6: Speed Reg Motor	Not allowed
1	Not allowed	DI1…DI5: Free DI6: First PFA Relay
2…6	Not allowed	Not allowed

Group 98: Options

This group configures for options, in particular, enabling serial communication with the drive.

Table 23: Group 98: Options

Code	Description	Range	Resolution	Default	S
9802	COMM PROT SEL	0…5	1	0 (NOT SEL)	☑
	Selects the communication protocol. 0 = NOT SEL – No communication protocol selected. 1 = STD MODBUS – The drive communicates with Modbus via the RS485 channel (X1-communications, terminal). • See also Group 53: EFB PROTOCOL. 2 = N2 – Enables fieldbus communication with the drive using Metasys N2 protocol via the RS485 serial link (X1-communications terminal). 3 = FLN – Enables fieldbus communication with the drive using FLN protocol via the RS485 serial link (X1-communications terminal). 4 = EXT FBA – The drive communicates via a fieldbus adapter module in option slot 2 of the drive. 5 = BACNET – Enables fieldbus communication with the drive using BACnet protocol via the RS485 serial link (X1-communications terminal).				

Overview

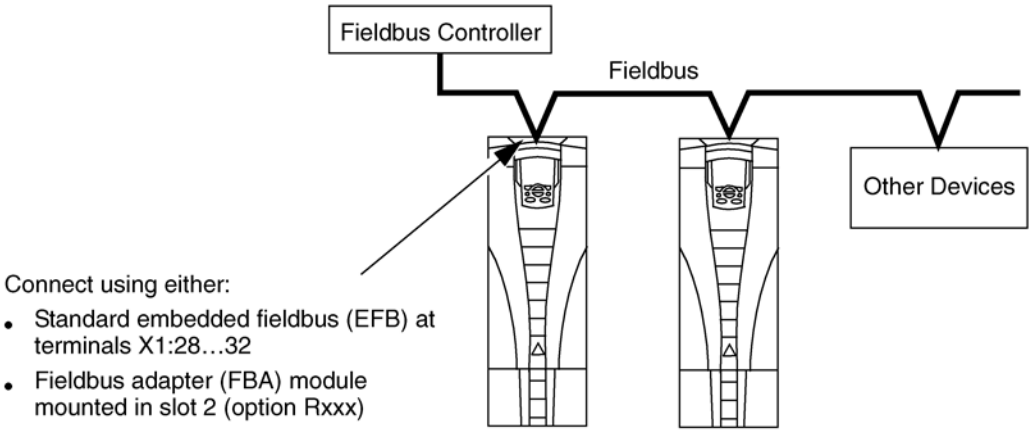
The MD5 can be set up to accept control from an external system using standard serial communication protocols. When using serial communication, the ACH550 can either:

- Receive all of its control information from the fieldbus, or
- Be controlled from some combination of fieldbus control and other available control locations, such as digital or analog inputs, and the control panel.

Two basic serial communications configurations are available:

- Embedded fieldbus (EFB) – Using the RS485 interface at terminals X1:28…32 on the control board, a control system can communicate with the drive using any of the following protocols:
  - Modbus®
  - Metasys® N2
  - APOGEE® FLN
  - BACnet®
- Fieldbus adapter (FBA) – See section Fieldbus Adapter on page 67.

Figure 6: MD5 Connections


Fieldbus Controller
Fieldbus
Other Devices
Connect using either:
• Standard embedded fieldbus (EFB) at terminals X1:28…32
• Fieldbus adapter (FBA) module mounted in slot 2 (option Rxxx)

Control Interface

In general, the basic control interface between the fieldbus system and the drive consists of:

Protocol	Control Interface	Reference for more information
Modbus	• Output Words – Control word – Reference1 – Reference2 • Input Words – Status word – Actual value 1 – Actual value 2 – Actual value 3 – Actual value 4 – Actual value 5 – Actual value 6 – Actual value 7 – Actual value 8	The content of these words is defined by profiles. For details on the profiles used. The MicroTech III control and the MD5 communicate over Modbus. All Modbus values are factory set and tested.
N2	• Binary output objects • Analog output objects • Binary input objects • Analog input objects	N2 protocol technical data
FLN	• Binary output points • Analog output points • Binary input points • Analog input points	FLN protocol technical data
BACnet	• Device management • Binary output objects • Analog output objects • Binary input objects • Analog input objects	BACnet protocol technical data

NOTE: The words “output” and “input” are used as seen from the fieldbus controller point of view. For example an output describes data flow from the fieldbus controller to the drive and appears as an input from the drive point of view.

Planning

Network planning should address the following questions:

- What types and quantities of devices must be connected to the network?
- What control information must be sent down to the drives?
- What feedback information must be sent from the drives to the controlling system?

Mechanical and Electrical Installation–EFB

⚠ WARNING

Connections should be made only while the drive is disconnected from the power source.

- Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120 Ω.
- Use one of these twisted shielded pairs for the RS485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- Use one of the wires in the other pair for the reference/common (terminal 31), leaving one wire unused.
- Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding earthing terminals.
- As always, the grounding wires should not form any closed loops, and all the devices should be earthed to a common ground.
- Connect the RS485 link in a daisy-chained bus, without dropout lines.
- To reduce noise on the network, terminate the RS485 network using 120 Ω resistors at both ends of the network. Use the DIP switch to connect or disconnect the termination resistors. See following wiring diagram. The MD5 termination resistor (J-2) are active terminators. This active circuit includes bins (“Pull-up” and “Pull-down”) resistors.
- Connect the shield at each end of the cable to a drive. On one end, connect the shield to terminal 28, and on the other end connect to terminal 32. Do not connect the incoming and outgoing cable shields to the same terminals, as that would make the shielding continuous.
- For configuration information see the following:
  - — Communication Setup – EFB on page 48.
  - — Activate Drive Control Functions – EFB on page 50..

Figure 7: Preferred Wiring Diagram

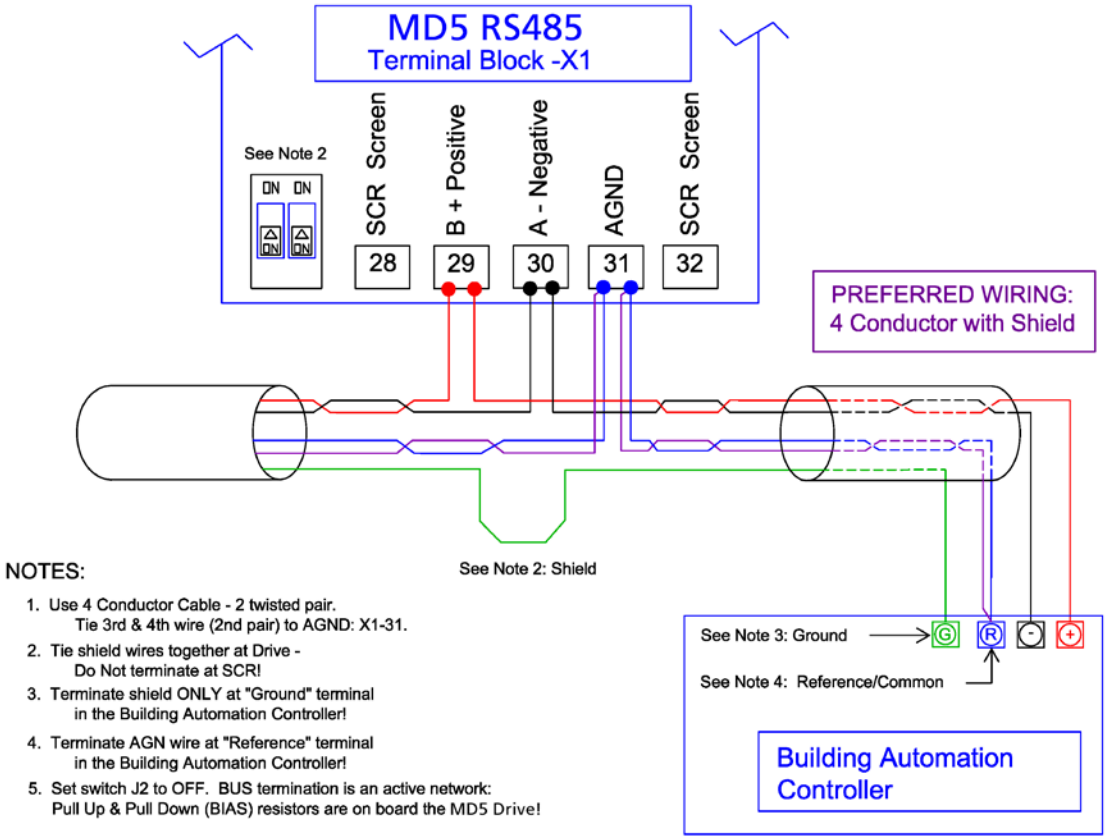
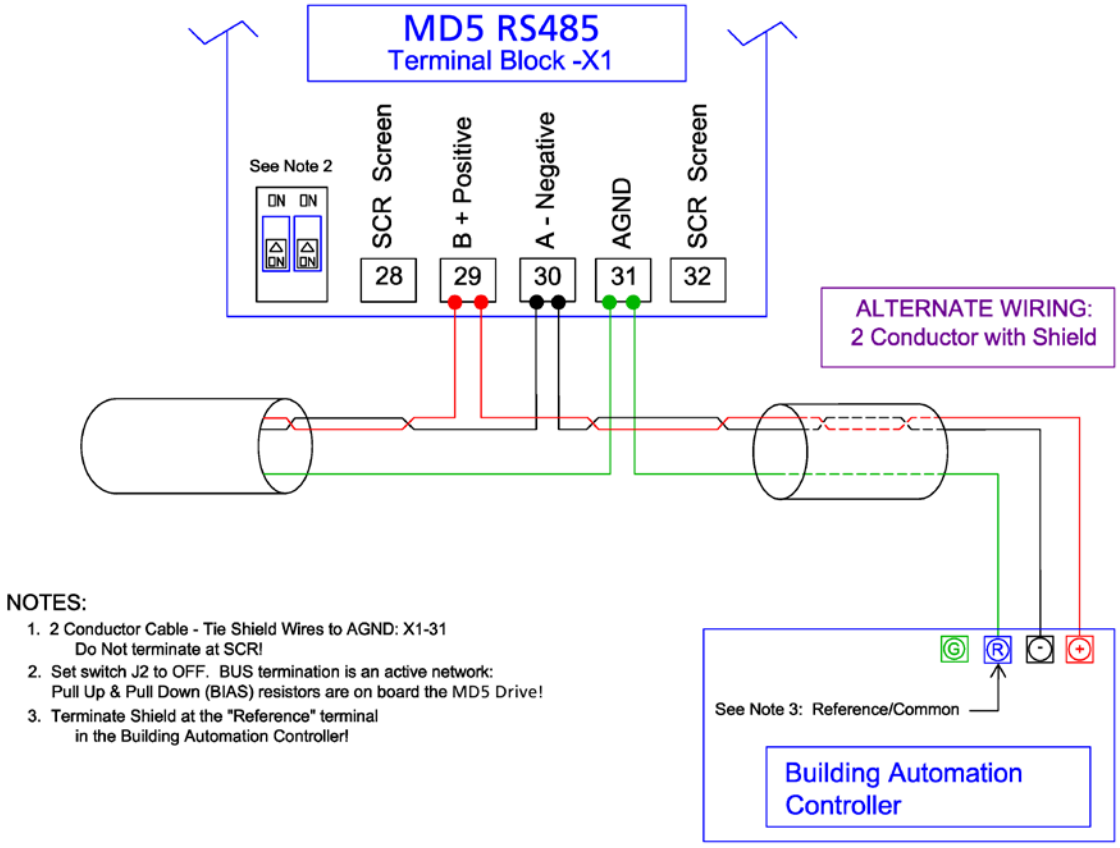

MD5 RS485
Terminal Block -X1
See Note 2
ON ON
SCR Screen
B + Positive
A - Negative
AGND
SCR Screen
28
29
30
31
32
PREFERRED WIRING:
4 Conductor with Shield
See Note 2: Shield
NOTES:
1. Use 4 Conductor Cable - 2 twisted pair.
Tie 3rd & 4th wire (2nd pair) to AGND: X1-31.
2. Tie shield wires together at Drive -
Do Not terminate at SCR!
3. Terminate shield ONLY at "Ground" terminal
in the Building Automation Controller!
4. Terminate AGN wire at "Reference" terminal
in the Building Automation Controller!
5. Set switch J2 to OFF. BUS termination is an active network:
Pull Up & Pull Down (BIAS) resistors are on board the MD5 Drive!
See Note 3: Ground
See Note 4: Reference/Common
Building Automation
Controller

Figure 8: Alternate Wiring Diagram



Communication Setup – EFB

Serial Communication Selection

To activate the serial communication, set parameter 9802 COMM PROTOCOL SEL =

- 1 (STD MODBUS).
- 2 (N2)
- 3 (FLN)
- 5 (BACNET)

NOTE: If you cannot see the desired selection on the panel, your drive does not have that protocol software in the application memory.

Serial Communication Configuration

Setting 9802 automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined below. In particular, note that the station ID may require adjustment.

Table 25: Serial Communication Configuration

Code	Description	EFB Protocol Reference			
		Modbus	**N2**	**FLN**	**BACnet**
5301	**EFB PROTOCOL ID** Contains the identification and program revision of the protocol.	Do not edit. Any non-zero value entered for parameter 9802 COMM PROT SEL, sets this parameter automatically. The format is: XXYY, where xx = protocol ID, and YY = program revision.			
5302	**EFB STATION ID** Defines the node address of the RS485 link.	When one of these protocols is selected, the default value for this parameter is: 1			When this protocol is selected, the default value for this parameter is: 128
		Set each drive on the network with a unique value for this parameter. **Note:** For a new address to take affect, the drive power must be cycled **OR** 5302 must first be set to 0 before selecting a new address. Leaving 5302 = 0 places the RS485 channel in reset, disabling communication.			
5303	**EFB BAUD RATE** Defines the communication speed of the RS485 link in kbits per second (kbits/s). 1.2 kbits/s 2.4 kbits/s 4.8 kbits/s 9.6 kbits/s 19.2 kbits/s 38.4 kbits/s 57.6 kbits/s 76.8 kbits/s	When this protocol is selected, the default value for this parameter is			When this protocol is selected, the default value for this parameter is: 38400.
		9.6	9.6 Do not edit.	4.8 Do not edit.	
5304	**EFB PARITY** Defines the data length, parity and stop bits to be used with the RS485 link communication. • The same settings must be used in all on-line stations. 0 = 8N1 – 8 data bits, No parity, one stop bit. 1 = 8N2 – 8 data bits, No parity, two stop bits. 2 = 8E1 – 8 data bits, Even parity, one stop bit. 3 = 8O1 – 8 data bits, Odd parity, one stop bit.	When this protocol is selected, the default value for this parameter is: 1	When this protocol is selected, the default value for this parameter is: 0 Do not edit.		

NOTE: For the BACnet protocol, the MD5 will function as a Master with MAC IDs in the range of 1 - 127. With MAC ID settings of 128 - 254, the drive is in Slave only behavior.

Table 25 continued: Serial Communication Configuration

Code	Description	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
5305	**EFB CTRL PROFILE** Selects the communication profile used by the EFB protocol. 0 = Daikin DRV LIM – Operation of Control/Status Words conform to Daikin Drives Profile (limited), as used in ACH400/550. 1 = DCU PROFILE – Operation of Control/Status Words conform to 32-bit DCU Profile. 2 = Daikin DRV FULL – Operation of Control/Status Words conform to Daikin Drives Profile (full).	When this protocol is selected, the default value for this parameter is: 0	N/A. When this protocol is selected, the default value for this parameter is: 0. Changing the value for this parameter has no affect on this protocol's behavior.		
5306	**EFB OK MESSAGES**	This parameter indicates the number of valid application messages received at this drive. This count does not include MS/TP token passing and polling messages. (For such messages, see 5316).			
5307	**EFB CRC ERRORS**	This parameter indicates the number of CRC errors detected, in either the header or data CRCs.			
5308	**EFB UART ERRORS**	This parameter indicates the number of UART-related errors (framing, parity) detected.			
5309	**EFB STATUS**	This parameter indicates the internal status of the EFB Protocol as follows: • IDLE – EFB Protocol is configured but not receiving messages. • TIMEOUT – Time between valid messages has exceeded the interval set by parameter 3019. • OFFLINE – EFB Protocol is receiving messages NOT addressed to this drive. • ONLINE – EFB Protocol is receiving messages addressed to this drive. • RESET – EFB Protocol is in reset. • LISTEN ONLY – EFB Protocol is in listen-only mode.			
5310	**EFB PAR10**	Not used for Comm setup.	Sets the response turnaround time in milliseconds in addition to any fixed delay imposed by the protocol. When this protocol is selected, the default value is:		
			3 ms	0 ms	5 ms
5311	**EFB PAR11**	Not used for Comm setup.			This parameter, together with parameter 5317, EFB PAR 17, sets BACnet Device Object Instance IDs: • For the range 1 to 65,535: Thips parameter sets the ID directly (5317 must be 0). For example, the following values set the ID to 49134: 5311 = 49134 and 5317 = 0. • For IDs > 65,335: The ID equals 5311's value plus 10,000 times 5317's value. For examle, the following values set the ID to 71234: 5311 = 1234 and 5317 = 7.
5314	**EFB PAR14**	Not used for Comm setup.			
5315	**EFB PAR15**	Not used for Comm setup.			
5316	**EFB PAR 16**	Not used for Comm setup.			This parameter indicates the count of MS/TP tokens passed to this drive.
5317	**EFB PAR17**				This parameter works with parameter 5311 to set BACnet Device Object Instance IDs. See parameter 5311, page 38.

NOTE: After any changes to the communication settings, protocol must be reactivated by either cycling the drive power, or by setting parameter 5302 EFB STATION ID to 0 and then restoring the station ID (5302) or use Reinitialize Device Service

Activate Drive Control Functions – EFB

Controlling the Drive

Fieldbus control of various drive functions requires configuration to:

- Tell the drive to accept fieldbus control of the function.
- Define as a fieldbus input, any drive data required for control.
- Define as a fieldbus output, any control data required by the drive.

The following sections describe, at a general level, the configuration required for each control function. For the protocol-specific details, see the document supplied with the FBA module.

Start/Stop Direction Control

Using the fieldbus for start/stop/direction control of the drive requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

NOTE: EXT1 = REF1 typically used for follower; EXT2 = REF2 typically used for PID setpoint.

Table 26: Start/Stop Direction Parameters

Drive Parameter	Value	Description	Protocol Reference				
			Modbus1		N2	FLN	BACnet
			Daikin DRV	DCU PROFILE			
1001	**EXT1 COMMANDS**	10 (COMM) Start/Stop by fieldbus with Ext1 selected.	40001 bits 0…3	40031 bits 0, 1 BO	24	BV10	
1002	**EXT2 COMMANDS**	10 (COMM) Start/Stop by fieldbus with Ext2 selected.	40001 bits 0…3	40031 bits 0, 1	BO1	24	BV10
1003	**DIRECTION**	3 (REQUEST) Direction by fieldbus.	4002/4003[2]	40031 bit 3	BO2	22	BV11

1. For Modbus, the protocol reference can depend on the profile used, hence two columns in these tables. One column refers to the Daikin Drives profile, selected when parameter 5305 = 0 (Daikin DRV LIM) or 5305 = 2 (Daikin DRV FULL). The other column refers to the DCU profile selected when parameter 5305 = 1 (DCU PROFILE). See Daikin control profiles technical data section.
2. The reference provides direction control – a negative reference provides reverse rotation.

Input Reference Select

Using the fieldbus to provide input references to the drive requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Reference Scaling

Where required, REFERENCES can be scaled. See the following, as appropriate:

- Modbus Register 40002 in the Modbus protocol technical data section.
- Reference scaling in the Daikin control profiles technical data section.
- N2 analog output objects in the N2 protocol technical data section.
- The slope of points 60 and 61 in the FLN protocol technical data section.

Table 27: Input Reference Parameters

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				Daikin DRV	DCU PROFILE			
1102	**EXT1/EXT2 SEL**	8 (COMM)	Reference set selection by fieldbus.	40001 bit 11	40031 bit 5	BO5	26	BV13
1103	**REF1 SEL**	8 (COMM)	Input reference 1 by fieldbus.	40002		AO1	60	AV16
1106	**REF2 SEL**	8 (COMM)	Input reference 2 by fieldbus.	40003		AO2	61	AV17

Miscellaneous Drive Control

Using the fieldbus for miscellaneous drive control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 28: Miscellaneous Drive Control Parameters

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				Daikin DRV	DCU PROFILE			
1601	**RUN ENABLE**	7 (COMM) (Not Recommended)	Run enable by fieldbus.	40001 bit 3	40031 bit 6 (inverted)	BO4	35	BV12
1604	**FAULT RESET SEL**	8 (COMM)	Fault reset by fieldbus.	40001 bit 7	40031 bit 4	BO6	94	BV14
1606	**LOCAL LOCK**	8 (COMM)	Source for local lock selection is the fieldbus.	Does not apply	40031 bit 14			
1607	**PARAM SAVE**	1 (SAVE)	Saves altered parameters to memory (then value returns to 0).	41607	40032 bit 2	BO18	N/A[1]	
1608	**START ENABLE 1**	7 (COMM) (Not Recommended)	Source for start enable 1 is the fieldbus Command word.	Does not apply.	40032 bit 2		BV20	
1609	**START ENABLE 2**	7 (COMM) (Not Recommended)	Source for start enable 2 is the fieldbus Command word.		40032 bit 3		BV21	
2013	**MIN TORQUE SEL**	7 (COMM)	Source for minimum torque selection is the fieldbus.		40031 bit 15			
2014	**MAX TORQUE SEL**	7 (COMM)	Source for maximum torque selection is the fieldbus.					
2201	**ACC/DEC 1/2 SEL**	7 (COMM)	Source for ramp pair selection is the fieldbus.		40031 bit 10			

1. Use Memorize Point command.

Relay Output Control

Using the fieldbus for relay output control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

For example: To control relays 1 and 2 using serial communication:

Set parameters 1401 RELAY OUTPUT 1 and 1402 RELAY OUTPUT 1 = 35 (COMM).

Then, for example using N2:

- To turn Relay 1 On: Force object B07 to On.
- To turn Relay 2 On: Force object B08 to On.
- To turn both Relay 1 and 2 On: Force objects B07 and B08 On.

NOTE: Relay status feedback occurs without configuration as defined below.

Table 29: Relay Output Control Parameters

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				Daikin DRV	DCU PROFILE			
1401	**RELAY OUTPUT 1**	35 (COMM)	Relay Output 1 controlled by fieldbus.	40134 bit 0 or 00033		BO7	40	BO0
1402	**RELAY OUTPUT 2**	35 (COMM)	Relay Output 2 controlled by fieldbus.	40134 bit 1 or 00034		BO8	41	BO1
1403	**RELAY OUTPUT 3**	35 (COMM)	Relay Output 3 controlled by fieldbus.	40134 bit 2 or 00035		BO9	42	BO2
1410[1]	**RELAY OUTPUT 4**	35 (COMM)	Relay Output 4 controlled by fieldbus.	40134 bit 3 or 00036		BO10	43	BO3
1411[1]	**RELAY OUTPUT 5**	35 (COMM)	Relay Output 5 controlled by fieldbus.	40134 bit 4 or 00037		BO11	44	BO4
1412[1]	**RELAY OUTPUT 6**	35 (COMM)	Relay Output 6 controlled by fieldbus.	40134 bit 5 or 00038		BO12	45	BO5
0122	**RO 1-3 STATUS**	Relay 1…3 status.	40122	0122		BI4… BI6	76… 78	BI0… BI2
0123	**RO 4-6 STATUS**	Relay 4…6 status.	40123	0123		BI7… BI9	79… 81	BI3… BI5

1. More than 3 relays requires the addition of a relay extension module.

Analog Output Control

Using the fieldbus for analog output control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 30: Analog Output Control Parameters

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				Daikin DRV	DCU PROFILE			
1501	**AO1 CONTENT SEL**	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	—		—	—	—
0135	**COMM VALUE 1**	—		40135		AO14	46	AO0
1507	**AO2 CONTENT SEL**	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	—		—	—	—
0136	**COMM VALUE 2**	—		40136		AO15	47	AO1

PID Control Setpoint Source

Use the following settings to select the fieldbus as the setpoint source for PID loops:

Table 31: PID Control Setpoint Parameters

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				Daikin DRV	DCU PROFILE			
4010	**SET POINT SEL (Set 1)**	8 (COMM VALUE 1) 9 (COMM + AI1) 10 (COMM*AI1)	Setpoint is either: • Input Reference 2 (+/-/* AI1). Control requires parameter 1106 value = comm. • Process PID setpoint. Control requires parameter 1106 value = pid1 out and parameter 4010 value = comm.	40003		AO2	61	AV17
4110	**SET POINT SEL (Set 2)**							
4210	**SET POINT SEL (Ext/Trim)**							

Communication Fault

When using fieldbus control, specify the drive's action if serial communication is lost.

Table 32: Communication Fault Parameters

Drive Parameter		Value	Description
3018	**COMM FAULT FUNC**	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive response.
3019	**COMM FAULT TIME**	Set time delay before acting on a communication loss.	

Feedback from the Drive – EFB

Pre-Defined Feedback

Inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration. The following table lists a sample of feedback data.

NOTE: With Modbus, any parameter can be accessed using the format: 4 followed by the parameter number.

Table 33: Pre-Defined Feedback

Drive Parameter		Protocol Reference			
		Modbus	N2	FLN	BACnet
0102	**SPEED**	40102	AI3	5	AV0
0103	**FREQ OUTPUT**	40103	AI1	2	AV1
0104	**CURRENT**	40104	AI4	6	AV4
0105	**TORQUE**	40105	AI5	7	AV5
0106	**POWER**	40106	AI6	8	AV6
0107	**DC BUS VOLT**	40107	AI11	13	AV2
0109	**OUTPUT VOLTAGE**	40109	AI12	14	AV3
0115	**KWH COUNTER**	40115	AI8	10	AV8
0118	**DI1-3 STATUS – bit 1 (DI3)**	40118	BI10, BI11, BI12,	70, 71, 72	BI6, BI7, BI8
0122	**RO1-3 STATUS**	40122	BI4, BI5, BI6	76, 77, 78	BI0, BI1, BI2
0301	**FB STATUS WORD – bit 0 (STOP)**	40301 bit 0	BI1	23	BV0
0301	**FB STATUS WORD – bit 2 (REV)**	40301 bit 2	BI2	21	BV

Mailbox Read/Write

The MD5 provides a “Mailbox” function to access parameters that have not been pre-defined by the protocol. Using mailbox, any drive parameter can be identified and read. Mailbox can also be used to adjust parameter settings by writing a value to any parameter identified. The following table describes the use of this function.

Table 34: Mailbox Read/Write Parameters

Name	Description	Protocol Reference			
		Modbus1	N2	FLN	BACnet
Mailbox Parameter	Enter the number of the drive parameter to access.	Does not apply.	AO19	95	AV25
Mailbox Data	Contains the parameter value after a read, or enter the desired parameter value for a write.		AO20	96	AV26
Mailbox Read	A binary value triggers a read – the value of the “Mailbox Parameter” appears in “Mailbox data”.		BO19	97	BV15
Mailbox Write	A binary value triggers a write – the drive value for the “Mailbox Parameter” changes to the value in “Mailbox data”.		BO20	98	BV16

1. As noted above, Modbus provides direct access to all parameters using the format: 4 followed by the parameter number.

Actual Value Scaling

The scaling of actual values can be protocol dependent. In general, for Actual Values, scale the feedback integer using the parameter's resolution. For example:

Feedback Integer	Parameter Resolution	(Feedback Integer) × (Parameter Resolution) = Scaled Value
1	**0.1 mA**	1 × 0.1 mA = 0.1 mA
10	**0.1%**	10 × 0.1% = 1%

Where parameters are in percent, the Complete parameter descriptions section specifies what parameter corresponds to 100%. In such cases, to convert from percent to engineering units, multiply by the value of the parameter that defines 100% and divide by 100%. For example:

Feedback Integer	Parameter Resolution	Value of the Parameter that defines 100%	(Feedback Integer) × (Parameter Resolution) × (Value of 100% Ref.) / 100% = Scaled Value
10	**0.1%**	1500 rpm[1]	10 * 0.1% * 1500 RPM / 100% = 15 rpm
100	**0.1%**	500 Hz[2]	100 * 0.1% * 500 Hz / 100% = 50 Hz

1. Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference, and that 9908 = 1500 rpm.
2. Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference, and that 9907 = 500 Hz.

Although Actual Value scaling could differ from the above for the N2 and FLN protocols, it currently does not. To confirm, see the following sections, as appropriate:

- N2 analog input objects in the N2 protocol technical data section.
- Scaling drive feedback values in the FLN protocol technical data section.

Scaling does not apply for the BACnet protocol.

Diagnostics – EFB

Fault Queue for Drive Diagnostics

For general MD5 diagnostics information, see Diagnostics on page 74. The three most recent MD5 faults are reported to the fieldbus as defined below. For specific MD5 fault codes, see Table 55: Fault Listing on page 75.

Table 35: MD5 Faults

Drive Parameter		Protocol Reference			
		Modbus	N2	FLN	BACnet
0401	**Last Fault**	40401	17	90	AV18
0412	**Previous Fault 1**	40402	18	91	AV19
0413	**Previous Fault 2**	40403	19	92	AV20

Serial Communication Diagnostics

Network problems can be caused by multiple sources. Some of these sources are:

- Loose connections
- Incorrect wiring (including swapped wires)
- Bad grounding
- Duplicate station numbers
- Incorrect setup of drives or other devices on the network

The major diagnostic features for fault tracing on an EFB network include Group 53 EFB Protocol parameters 5306…5309. The Complete parameter descriptions section describes these parameters in detail.

Diagnostic Situations

The sub-sections below describe various diagnostic situations – the problem symptoms and corrective actions.

Normal Operation

During normal network operation, 5306…5309 parameter values act as follows at each drive:

- 5306 EFB OK MESSAGES advances (advances for each application message properly received and addressed to this drive).
- 5307 EFB CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5308 EFB UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors).
- 5309 EFB status value varies depending on network traffic.
- BACnet protocol: 5316 EFB PAR 16 (MS/TP token counter) advances for each token passed to this drive. (Does not apply for other protocols.)

Loss of Communication

The action taken by the MD5, if communication is lost, is configured in Communication fault. The parameters are 3018 COMM FAULT FUNC and 3019 COMM FAULT TIME. The Complete parameter descriptions section on page 1-80 describes these parameters.

No Master Station On Line

If no master station is on line: Neither the EFB OK MESSAGES nor the errors (5307 EFB CRC ERRORS and 5308 EFB UART ERRORS) increase on any of the stations.

To correct:

- Check that a network master is connected and properly programmed on the network.
- Verify that the cable is connected, and is not cut or short circuited.

Duplicate Stations

If two or more stations have duplicate numbers:

- Two or more drives cannot be addressed.
- Every time there is a read or write to one particular station, the value for 5307 EFB CRC ERRORS or 5308 EFB UART ERRORS advances.

To correct: Check all station numbers and edit conflicting values.

Swapped Wires

If the communication wires are swapped (terminal A on one drive is connected to terminal B on another):

- The value of 5306 EFB OK MESSAGES does not advance.
- The values of 5307 EFB CRC ERRORS and 5308 EFB UART ERRORS are advancing.

To correct: Check that the EIA-485 lines are not swapped.

Fault 28 – Serial 1 Err

If the drive's control panel shows fault code 28 "SERIAL 1 ERR", check for either of the following:

- The master system is down. To correct, resolve problem with master system.
- The communication connection is bad. To correct, check communication connection at the drive.
- The time-out selection for the drive is too short for the given installation. The master is not polling the drive within the specified time-out delay. To correct, increase the time set by parameter 3019 COMM FAULT TIME.

Fault 31 – EFB1

For BACnet: If the drive's control panel shows fault code 31 "EFB1", the drive has an invalid Device Object Instance ID. To correct, use parameters 5311 and 5317 and establish a unique drive ID that is in the range 1 to 4,194,303.

Faults 31…33 – EFB1…EFB3

Except as noted above, these three EFB fault codes (listed for the drive in Diagnostics on page 74, fault codes 31…33) are not used.

Intermittent off-line occurrences

The problems described above are the most common problems encountered with MD5 serial communication. Intermittent problems might also be caused by:

- Marginally loose connections,
- Wear on wires caused by equipment vibrations,
- Insufficient grounding and shielding on both the devices and on the communication cables.
- Two conductor wire (plus shield) is in use instead of the recommended three conductor wire (plus shield), see page 46.

Troubleshooting

The troubleshooting table below should be followed in order from top to bottom by parameter number. Begin the troubleshooting process by displaying the first parameter in the table (5308) and determining if the display on the panel exhibits the symptom. If it does, review the possible cause(s) and take the necessary corrective action(s). Once the symptom for this parameter is eliminated, continue to the next parameter and repeat the process until you have reached the end.

Table 36: Troubleshooting

Parameter Number	Display on Panel (Symptom)	Possible Cause	Corrective Action
5308 UART ERRORS	**Rapidly Increasing Numeric Value**[1]	1. Duplicate Addresses 2. Swapped Wires 3. Incorrect Baud Rate 4. Incorrect Parity 5. Too many devices on wire 6. Incorrect Bias 7. Noise on EIA-485 wire 8. Blown EIA-485 transceiver	1. Ensure EFB PROTOCOL parameters 5302 [also 5311 & 5317 when using BACnet] are unique. 5302 must be a unique address on the segment. [5311 & 5317 must be unique addresses on the network when using BACnet.] 2. Swap wires B(+) & A(-). 3. Adjust parameter 5303 & Cycle power. 4. Change parity using parameter 5304 & cycle power. 5. Limit to 31 devices on 1 segment. 6. Turn off VFD termination resistors (move jumpers). Install loose resistor recommended by the DCS controls company. (Terminate final device on the trunk.) 7. Install EIA-485 (3 conductor shielded) data grade cable communications wire. See drawings on page 1-190. 8. Find and correct ground loop or high voltage problems before replacing any component assemblies. Perform the following steps to determine if the EIA-485 transceiver is damaged. a. Power unit down. b. Remove bus wires and retighten connections. c. Turn bus termination ON. d. Measure impedance between B(+) & A(-). MD5 164 ohms +/- 5% If measurements are not within the specified range the EIA-485 transceiver is bad, replace the assembly containing the EIA-485 port.
5307 (5007) DV CRC ERR	**Rapidly Increasing Numeric Value**[1]	1. Duplicate Addresses 2. Too many devices on wire 3. Noise on EIA-485 wire	1. See Corrective Action 1. Parameter Number 5308 2. Limit to 31 unit loads on 1 segment (MD5 = 1 unit load) 3. See Corrective Action 7. Parameter Number 5308
5309 (5009) DV STATUS	**IDLE**	1. No network connection 2. Blown EIA-485 transceiver 3. Wrong application number (FLN only)	1. Land communication wires as shown in drawings on page1-190. Check Repeater (if installed onsite). 2. See Corrective Action 8. Parameter Number 5308. 3. Change application number in the Siemens field panel.
5316 (5016) DV PAR 16 (BACnet Only)	**Not Increasing Numeric Value**	1. Drive device address parameter 5302 is set to 128 or greater. 2. Max Masters is set too low on all drives.	1. Change parameter 5302 to a unique value below 128. 2. Change Max Masters property at all devices on bus to 127.
5306 (5006) DV OK MSG	**OK Message Counter not increasing**[1]	1. Master/Client not communicating with drive. 2. Failed router	1. Add device and points to the building control system. 2. Replace router.

1. Reset by pressing UP & DOWN arrows simultaneously in edit mode. Save change by pressing ENTER.

BACnet Protocol Technical Data

Binary Input Object Instance Summary

The following table summarizes the Binary Input Objects supported:

Table 37: Binary Input Objects

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BI0	**RO 1 ACT**	This object indicates the status of Relay Output 1.	ON/OFF	R
BI1	**RO 2 ACT**	This object indicates the status of Relay Output 2.	ON/OFF	R
BI2	**RO 3 ACT**	This object indicates the status of Relay Output 3.	ON/OFF	R
BI3	**RO 4 ACT**	This object indicates the status of Relay Output 4 (requires OREL-01 option).	ON/OFF	R
BI4	**RO 5 ACT**	This object indicates the status of Relay Output 5 (requires OREL-01 option)	ON/OFF	R
BI5	**RO 6 ACT**	This object indicates the status of Relay Output 6 (requires OREL-01 option)	ON/OFF	R
BI6	**DI 1 ACT**	This object indicates the status of Digital Input 1.	ON/OFF	R
BI7	**DI 2 ACT**	This object indicates the status of Digital Input 2.	ON/OFF	R
BI8	**DI 3 ACT**	This object indicates the status of Digital Input 3.	ON/OFF	R
BI9	**DI 4 ACT**	This object indicates the status of Digital Input 4.	ON/OFF	R
BI10	**DI 5 ACT**	This object indicates the status of Digital Input 5.	ON/OFF	R
BI11	**DI 6 ACT**	This object indicates the status of Digital Input 6.	ON/OFF	R

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Binary Output Object Instance Summary

The following table summarizes the Binary Output Objects supported:

Table 38: Binary Output Objects

Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BO0	**RO1 COMMAND**	This object controls the output state of Relay 1. This control requires that parameter 1401 value = COMM.	ON/OFF	C
BO1	**RO2 COMMAND**	This object controls the output state of Relay 2. This control requires that parameter 1402 value = COMM.	ON/OFF	C
BO2	**RO3 COMMAND**	This object controls the output state of Relay 3. This control requires that parameter 1403 value = COMM.	ON/OFF	C
BO3	**RO4 COMMAND**	This object controls the output state of Relay 4. This control requires that parameter 1410 value = COMM (also requires OREL-01 option).	ON/OFF	C
BO4	**RO5 COMMAND**	This object controls the output state of Relay 5. This control requires that parameter 1411 value = COMM (also requires OREL-01 option).	ON/OFF	C
BO5	**RO6 COMMAND**	This object controls the output state of Relay 6. This control requires that parameter 1412 value = COMM (also requires OREL-01 option).	ON/OFF	C

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Binary Value Object Instance Summary

The following table summarizes the Binary Value Objects supported:

Table 39: Binary Value Objects

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BV0	**RUN/STOP ACT**	This object indicates the drive Run Status, regardless of the control source.	RUN/STOP	R
BV1	**FWD/REV ACT**	This object indicates the motor's rotation direction, regardless of the control source.	REV/FWD	R
BV2	**FAULT ACT**	this object indicates the drive's fault status.	FAULT/OK	R
BV3	**EXT 1/2 ACT**	This object indicates which control source is active: External 1 or External 2.	EXT2/EXT1	R
BV4	**HAND/AUTO ACT**	This object indicates whether the drive is under Hand or Auto control.	HAND/AUTO	R
BV5	**ALARM ACT**	This object indicates the drive's alarm status.	ALARM/OK	R
BV6	**MAINT REQ**	This object indicates the drive's maintenance status. Refer to Group 29 in the drive's parameter descriptions.	MAINT/OK	R
BV7	**DRIVE READY**	This object indicates whether the drive is ready to accept a run command.	READY/NOT READY	R
BV8	**AT SETPOINT**	This object indicates whether the drive is at the commanded setpoint.	YES/NO	R
BV9	**RUN ENA ACT**	This object indicates the Run Enable command status, regardless of the control source.	ENABLE/DISABLE	R
BV10	**RUN/STOP CMD**	This object commands a drive start. Control requires either: • Parameter 1001 value = COMM for control by EXT1 or • Parameter 1002 value = COMM for control by EXT2.	RUN/STOP	C
BV11	**FWD/REV CMD**	This object commands a motor rotation direction change. Control requires 1003 = REQUEST and either: • Parameter 1001 value = COMM for control by EXT1 or • Parameter 1002 value = COMM for control by EXT2.	REV/FWD	C
BV12	**RUN ENA CMD**	This object commands Run Enable. Control requires parameter 1601 value = COMM.	ENABLE/DISABLE	C
BV13	**EXT 1/2 CMD**	This object selects ext1 or ext2 as the active control source. Control requires parameter 1102 value = COMM.	EXT2/EXT1	C
BV14	**FAULT RESET**	This object resets a faulted drive. The command is rising edge triggered. Control requires parameter 1604 value = COMM.	RESET/NO	C
BV15	**MBOX READ**	This object reads a parameter (defined by AV25 MBOX PARAM) and returns it in AV26 MBOX DATA.	READ/RESET	W
BV16	**MBOX WRITE**	This object writes the data value specified by AV26, MBOX DATA, to a parameter (defined by AV25, MBOX PARAM).	WRITE/RESET	W
BV17	**LOCK PANEL**	This object locks the panel and prevents parameter changes. The corresponding drive parameter is 1602.	LOCK/UNLOCK	W
BV18	**CTL OVERRIDE CMD**	This object commands the drive into BACnet Control Override. In this mode, BACnet takes drive control from the normal source. However, the control panel's HAND mode has priority over BACnet Control Override.	ON/OFF	C
BV19	**CTL OVERRIDE ACT**	This object indicates whether the drive is in BACnet Control Override. (See BV18.)	ON/OFF	R
BV20	**START ENABLE 1**	This object commands start enable1. Control requires param 1608 value = COMM.	ENABLE/DISABLE	C
BV21	**START ENABLE 2**	This object commands start enable1. Control requires param 1609 value = COMM.	ENABLE/DISABLE	C

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Input Object Instance Summary

The following table summarizes the Analog Input Objects supported:

Table 40: Analog Input Objects

Instance ID	Object Name	Description	Units	Present Value Access Type
AI0	**ANALOG INPUT 1**	This object indicates the value of Analog Input 1. The corresponding drive parameter is 0120.	Percent	R
AI1	**ANALOG INPUT 2**	This object indicates the value of Analog Input 2. The corresponding drive parameter is 0121.	Percen	R

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Output Object Instance Summary

The following table summarizes the Analog Output Objects supported:

Table 41: Analog Output Objects

Instance ID	Object Name	Description	Units	Present Value Access Type
AO0	**AO 1 COMMAND**	This object controls Analog Output 1. The corresponding drive parameter is 0135, COMM VALUE 1. Control requires parameter 1501 value = 135.	Percent	C
AO1	**AO 2 COMMAND**	This object controls Analog Output 2. The corresponding drive parameter is 0136, COMM VALUE 2. Control requires parameter 1507 value = 136.	Percent	C

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Value Object Instance Summary

The following table summarizes the Analog Value Objects supported:

Table 42: Analog Value Objects

Instance ID	Object Name	Description	Units	Present Value Access Type
AV0	**OUTPUT SPEED**	This object indicates the calculated motor speed in RPM. The corresponding drive parameter is 0102.	RPM	R
AV1	**OUTPUT FREQ**	This object indicates the output frequency applied to the motor in Hz. The corresponding drive parameter is 0103.	Hertz	R
AV2	**DC BUS VOLT**	This object indicates the drive's DC bus voltage level. The corresponding drive parameter is 0107.	Volts	R
AV3	**OUTPUT VOLT**	This object indicates the AC output voltage applied to the motor. The corresponding drive parameter is 0109.	Volts	R
AV4	**CURRENT**	This object indicates the measured output current. The corresponding drive parameter is 0104.	Amps	R
AV5	**TORQUE**	This object indicates the calculated motor output torque as a percentage of nominal torque. The corresponding drive parameter is 0105.	Percent	R
AV6	**POWER**	This object indicates the measured output power in kW. The corresponding drive parameter is 0106.	Kilowatts	R
AV7	**DRIVE TEMP**	This object indicates the measured heatsink temperature in °C. The corresponding drive parameter is 0110.	°C	R
AV8	**KWH (R)**	This object indicates, in kW hours, the drive's accumulated energy usage since the last reset. The value can be reset to zero. The corresponding drive parameter is 0115.	kWh	W
AV9	**KWH (NR)**	This object indicates the drive's accumulated energy usage in kW hours. The value cannot be reset.	kWh	R
AV10	**PRC PID FBCK**	This object is the Process PID feedback signal. The corresponding drive parameter is 0130.	Percent	R
AV11	**PRC PID DEV**	This object is the Process PID output signal's deviation from its setpoint. The corresponding drive parameter is 0132.	Percent	R
AV12	**EXT PID FBCK**	This object is the External PID feedback signal. The corresponding drive parameter is 0131.	Percent	R
AV13	**EXT PID DEV**	This object is the External PID output signal's deviation from its setpoint. The corresponding drive parameter is 0133.	Percent	R
AV14	**RUN TIME (R)**	This object indicates, in hours, the drive's accumulated run time since the last reset. The value can be reset to zero. The corresponding drive parameter is 0114.	Hours	W
AV15	**MOTOR TEMP**	This object indicates the drive's motor temperature.	°C	R
AV16	**INPUT REF 1**	This object sets Input Reference 1. Control requires parameter 1103 value = COMM.	Percent	C
AV17	**INPUT REF 2**	This object sets either: • Input Reference 2. Control requires parameter 1106 value = COMM. • Process PID setpoint. Control requires parameter 1106 value = PID1 OUT and parameter 4010 value = COMM.	Percent	C
AV18	**LAST FLT**	This object indicates the most recent fault entered in the drive's fault log. The corresponding drive parameter is 0401.	None	R
AV19	**PREV FLT 1**	This object indicates the second most recent fault entered in the drive's fault log. The corresponding drive parameter is 0412.	None	R
AV20	**PREV FLT 2**	This object indicates the third most recent fault entered in the drive's fault log. The corresponding drive parameter is 0413.	None	R
AV21	**AO 1 ACT**	This object indicates Analog Output 1's level. The corresponding drive parameter is 0124.	Milliamps	R
AV22	**AO 2 ACT**	This object indicates Analog Output 2's level. The corresponding drive parameter is 0125.	Milliamps	R
AV23	**ACCEL1 TIME**	This object sets the Ramp1 acceleration time. The corresponding drive parameter is 2202.	Seconds	W
AV24	**DECEL1 TIME**	This object sets the Ramp1 deceleration time. The corresponding drive parameter is 2203.	Seconds	W
AV25	**MBOX PARAM**	This object defines the parameter to be read or written to by the mailbox function. See BV15 and BV16.	None	W

Table 42 continued: Analog Value Objects

AV26	MBOX DATA	This object holds the mailbox function's parameter value – a value that was read, or is to be written. See BV15 and BV16.	None	W
AV27	EXT PID STPT	This object sets the External PID controller setpoint. The corresponding drive parameter is 4211. Control requires parameter 4210, PID SETPOINT SEL, value = 19 (INTERNAL).	Percent	C

NOTE: For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

BACnet Quick-Start Sequence

The following steps summarize the process for enabling and configuring BACnet on the MD5:

1. Enable BACnet protocol: Set drive parameter 9802, COMM PROTOCOL SEL = BACNET (5).

NOTE: If you cannot see the desired selection on the panel, your drive does not have that protocol software in the application memory.

   — To confirm this selection, read drive parameter 5301, EFB PROTOCOL ID. It should read x5xx (where "x" is any value).

2. Place the BACnet channel in "reset": Set drive parameter 5302, EFB STATION ID = 0.

   — This setting holds the BACnet communication channel in reset while remaining settings are completed.

3. Define the MS/TP baud rate.

   — Set drive parameter 5303, EFB BAUD RATE = appropriate value.

4. Define the Device Object Instance ID.

   — To define a specific device object instance value, use drive parameters 5311 and 5317 (object instance values must be unique and in the range 1 to 4,194,303).

   — To use the drive's MS/TP MAC ID as the device object instance value, set drive parameter 5311 and 5317 = 0.

   — BACnet requires a unique Device Object ID for each device on the BACnet network.

5. Define a unique MS/TP MAC ID. Set drive parameter 5302, EFB STATION ID = appropriate value.

   — Once this parameter is set to a non-zero value, current BACnet settings are "latched" and used for communication until the channel is reset.

   — In order to participate in MS/TP token passing, the MAC ID used must be within the limits defined by other masters' "Max Master" property.

6. Confirm proper BACnet communication.

   — When BACnet communication is operating properly, drive parameter 5316, EFB PAR 16 (the MS/TP token counter), should be continually increasing.

   — Drive parameter 5306, UART ERRORS, should be stable. (With autobaud detection, this parameter may increase until the proper baud rate is detected.)

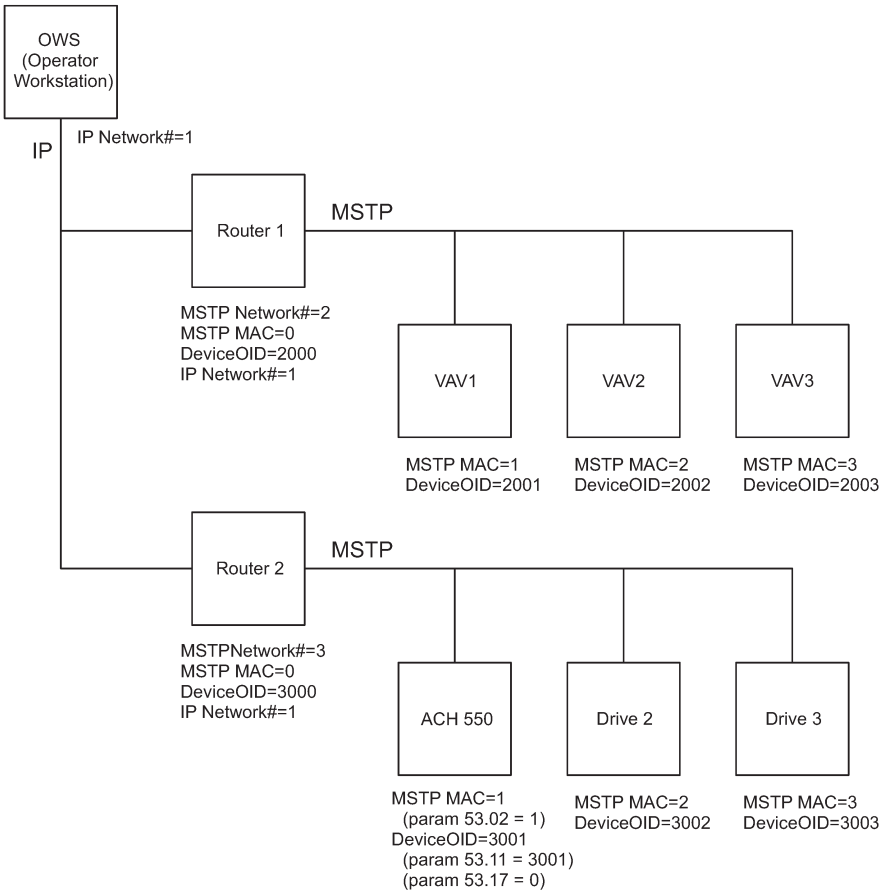
7. Configure the Device Object Name.

   — BACnet requires a unique name for each device on the BACnet network. Write the Object Name of the Device Object of the drive to a unique text string using the operator workstation or software tool capable of writing BACnet properties. The Object Name cannot be modified with the Daikin display panel and only the Device Object name is writable in this product. We do not support writing of Device Description.

BACnet Device Address Rules

- MSTP MAC Addresses must be unique for all devices connected to the same RS485 network.
- MSTP MAC Address is configurable via parameter 5302 in MD5. 1..127 = range of supported Master addresses for MD5
- Network Number must be unique for each network (IP and MSTP)
- Network Number of 0 is reserved for broadcasts
- Device Object IDs must be unique across the entire BACnet network, all IP and MSTP subnetworks.
- Device Object IDs are 22 bits, configurable via parameters 5311 and 5317 in MD5.
- The example Network Numbers and DeviceOIDs show a good way to maintain unique DeviceOIDs across the network.

Figure 9: Device Address Rules



Protocol Implementation Conformance Statement (PICS)

PICS Summary

BACnet Standard Device Profile. This version of MD5 BACnet fully conforms to the 'Application-Specific Controller' standard device profile (B-ASC).

Services Supported. The following services are supported by the MD5:

- I-Am (Response to Who-Is, also broadcast on power-up & other reset)
- I-Have (Response to Who-Has)
- ReadProperty
- WriteProperty
- DeviceCommunicationControl
- ReinitializeDevice

Data Link Layer. The MD5 implements MS/TP (Master) Data Link Layer. All standard MS/TP baud rates are supported (9600, 19200, 38400 & 76800).

MAC ID / Device Object Instance. The MD5 supports separate MAC ID and Device Object Instance parameters:

- Set the MAC ID using drive parameter 5302. Default: 5302 = 128.
- Set the Device Object Instance ID using drive parameters 5311 and 5317. Default: Both 5311 and 5317 = 0, which causes the MAC ID to "double" as the Device Object Instance. For Device Object Instance values not linked to the MAC ID, set ID values using 5311 and 5317:
  - For IDs in the range 1 to 65,535: Parameter 5311 sets the ID directly (5317 must be 0). For example, the following values set the ID to 49,134: 5311 = 49134 and 5317 = 0.
  - For IDs > 65,335: The ID equals 5311's value plus 10,000 times 5317's value. For example, the following values set the ID to 71,234: 5311 = 1234 and 5317 = 7.

Max Info Frames Property. Configure the Device Object Max Info Frames property, page 38, using drive parameter 5312. Default: 5312 = 1.

Max Master Property. Configure the Device Object Max Master property using drive parameter 5313, page 38. Default: 5313 = 127.

MS/TP token counter

Parameter 5316 stores the count of MS/TP tokens passed to the associated node.

Statement

This statement is part of this Standard and is required for its use.

Table 43: BACnet Protocol Implementation Conformance Statement

Date:	February 5, 2009
Vendor Name:	Daikin
Product Name:	Low Voltage AC Motor Drive
Product Model Number:	MD5
Applications Software Version:	050F
Firmware Revision:	312B
BACnet Protocol Revision:	4
Product Description:	The MD5 is a high-performance adjustable frequency drive specifically designed for commercial automation applications. This product supports native BACnet, connecting directly to the MS/TP LAN. All standard MS/TP baud rates are supported, as well as master mode functionality. Over BACnet, the drive can be fully controlled as a standard adjustable frequency drive. In addition, up to 16 configurable I/O ports are available over BACnet for user applications.
BACnet Standardized Device Profile (Annex L):	☐ BACnet Operator Workstation (B-OWS) ☐ BACnet Building Controller (B-BC) ☐ BACnet Advanced Application Controller (B-AAC) ☑ BACnet Application Specific Controller (B-ASC) ☐ BACnet Smart Sensor (B-SS) ☐ BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building Blocks Supported (Annex K):	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B.
Segmentation Capability:	☐ Segmented requests supported. Window Size ____ ☐ Segmented responses supported. Window Size ____
Standard Object Types Supported: An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data: 1) Whether objects of this type are dynamically creatable using the CreateObject service 2) Whether objects of this type are dynamically detectable using the DeleteObject service 3) List of the optional properties supported 4) List of all properties that are writable where not otherwise required by this standard 5) List of proprietary properties and for each its property identifier, datatype, and meaning 6) List of any property range restrictions	See table at Object/Property Support Matrix on page 66
Data Link Layer Options:	☐ BACnet IP, (Annex J), Foreign Device ☐ ISO 8802-3, Ethernet (Clause 7) ☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8) ☐ ANSI/ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s) ___ ☑MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 ☐ MS/TP slave (Clause 9), baud rate(s): ___ ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): ___ ☐ Point-To-Point, modem, (Clause 10), baud rate(s): ___ ☐ LonTalk, (Clause 11), medium: _____ ☐ Other: _____
Device Address Binding: Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)	☐ Yes ☑No
Networking Options:	☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc. ☐ Annex H, BACnet Tunneling Router over IP ☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices?	☐ Yes ☐ No
Character Sets Supported: Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	☑ANSI X3.4 ☐ IBM®/Microsoft® DBCS ☐ ISO 8859-1 ☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226
If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:	

BACnet Object Definitions

Object/Property Support Matrix

The following table summarizes the Object Types/Properties Supported:

Table 44: BACnet Objects

Property	Object Type						
	Device	Binary Input	Binary Output	Binary Value	Analog Input	Analog Output	Analog Value
Object Identifier	✓	✓	✓	✓	✓	✓	✓
Object Name	✓	✓	✓	✓	✓	✓	✓
Object Type	✓	✓	✓	✓	✓	✓	✓
System Status	✓						
Vendor Name	✓						
Vendor Identifier	✓						
Model Name	✓						
Firmware Revision	✓						
Appl Software Revision	✓						
Protocol Version	✓						
Protocol Revision	✓						
Services Supported	✓						
Object Types Supported	✓						
Object List	✓						
Max APDU Length	✓						
Segmentation Support	✓						
APDU Timeout	✓						
Number APDU Retries	✓						
Max Master	✓						
Max Info Frames	✓						
Device Address Binding	✓						
Database Revision	✓						
Present Value	✓	✓	✓	✓	✓	✓	
Status Flags	✓	✓	✓	✓	✓	✓	
Event State	✓	✓	✓	✓	✓	✓	
Out-of-Service	✓	✓	✓	✓	✓	✓	
Units	✓	✓	✓				
Priority Array	✓	✓*	✓	✓*			
Relinquish Default	✓	✓*	✓	✓*			
Polarity	✓	✓					
Active Text	✓	✓	✓				
Inactive Text	✓	✓	✓				

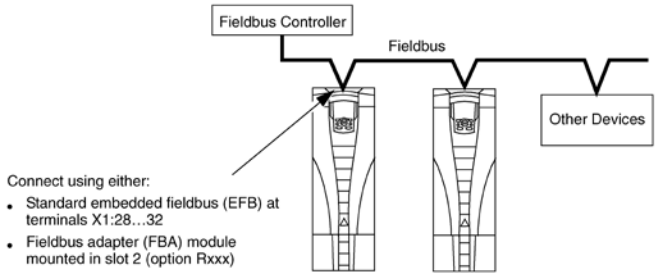
* For commandable values only.

Overview

The MD5 can be set up to accept control from an external system using standard serial communication protocols. When using serial communication, the MD5 can either:

- Receive all of its control information from the fieldbus, or
- Be controlled from some combination of fieldbus control and other available control locations, such as digital or analog inputs, and the control panel.

Figure 10: Available Control Locations


Fieldbus Controller
Fieldbus
Other Devices
Connect using either:
Standard embedded fieldbus (EFB) at terminals X1:28…32
Fieldbus adapter (FBA) module mounted in slot 2 (option Rxxx)

Two basic serial communications configurations are available:

- Embedded fieldbus (EFB) – See Embedded Fieldbus on page 45.
- Fieldbus adapter (FBA) – With one of the optional FBA modules in the drive's expansion slot 2, the drive can communicate to a control system using one of the following protocols:
  - Profibus-DP®
  - LonWorks®
  - CANopen®
  - DeviceNet®
  - ControlNet®
  - Ethernet®

The MD5 detects automatically which communication protocol is used by the plug-in fieldbus adapter. The default settings for each protocol assume that the profile used is the protocol's industry-standard drive profile (e.g. PROFIdrive for PROFIBUS, AC/DC Drive for DeviceNet). All of the FBA protocols can also be configured for the Daikin Drives profile.

Configuration details depend on the protocol and profile used. These details are provided in a user's manual supplied with the FBA module.

Details for the Daikin Drives profile (which apply for all protocols) are provided in Daikin drives profile technical data on page 89.

Control interface

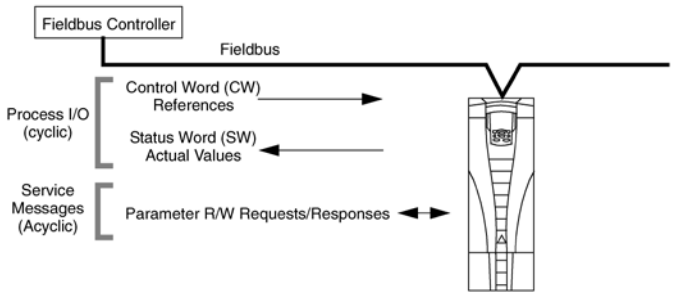
In general, the basic control interface between the fieldbus system and the drive consists of:

- Output Words:
  - CONTROL WORD
  - REFERENCE (speed or frequency)
  - Others: The drive supports a maximum of 15 output words. Protocols limits may further restrict the total.
- Input Words:
  - STATUS WORD
  - Actual Value (speed or frequency)
  - Others: The drive supports a maximum of 15 input words. Protocols limits may further restrict the total.

NOTE: The words "output" and "input" are used as seen from the fieldbus controller point of view. For example an output describes data flow from the fieldbus controller to the drive and appears as an input from the drive point of view.

The meanings of the controller interface words are not restricted by the MD5. However, the profile used may set particular meanings.

Figure 11: Controller Interface Words



Control Word

The CONTROL WORD is the principal means for controlling the drive from a fieldbus system. The fieldbus controller sends the CONTROL WORD to the drive. The drive switches between states according to the bit-coded instructions in the CONTROL WORD. Using the CONTROL WORD requires that:

- The drive is in remote (REM) control.
- The serial communication channel is defined as the source for controlling commands from EXT1 (set using parameters 1001 EXT1 COMMANDS and 1102 EXT1/ EXT2 SEL).
- The external plug-in fieldbus adapter is activated:
  - Parameter 9802 COMM PROT SEL = 4 (EXT FBA).
  - The external plug-in fieldbus adapter is configured to use the drive profile mode or drive profile objects.

The content of the CONTROL WORD depends on the protocol/ profile used. See the user's manual provided with the FBA module and/or the Daikin drives profile technical data.

Status Word

The STATUS WORD is a 16-bit word containing status information, sent by the drive to the fieldbus controller. The content of the STATUS WORD depends on the protocol/profile used. See the user's manual provided with the FBA module and/or the Daikin drives profile technical data section.

Reference

The contents of each REFERENCE word:

- Can be used, as speed or frequency reference.
- Is a 16-bit word comprised of a sign bit and a 15-bit integer.
- Negative references (indicating reversed rotation direction) are indicated by the two's complement of the corresponding positive reference value.

The use of a second reference (REF2) is supported only when a protocol is configured for the Daikin Drives profile.

Reference scaling is fieldbus type specific. See the user's manual provided with the FBA module and/or the following sections as appropriate:

- Daikin drives profile technical data
- Generic profile technical data

Actual Values

Actual Values are 16-bit words containing information on selected operations of the drive. Drive Actual Values (for example, group 01 parameters) can be mapped to Input Words using group 51 parameters (protocol-dependent, but typically parameters 5104…5126).

NOTE: This is not required with MicroTech III controls.

Planning

Network planning should address the following questions:

- What types and quantities of devices must be connected to the network?
- What control information must be sent down to the drives?
- What feedback information must be sent from the drives to the controlling system?

Communication Setup – FBA

Serial Communication Selection

To activate the serial communication, use parameter 9802 COMM PROTOCOL SEL. Set 9802 = 4 (EXT FBA).

Serial communication configuration

Setting 9802, together with mounting a particular FBA module, automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined in the user's manual supplied with the FBA module.

NOTE: This is not required with MicroTech III controls.

- Parameter 5101 is automatically configured.
- Parameters 5102…5126 are protocol-dependent and define, for example, the profile used, and additional I/O words. These parameters are referred to as the fieldbus configuration parameters. See the user's manual provided with the FBA module for details on the fieldbus configuration parameters.
- Parameter 5127 forces the validation of changes to parameters 5102…5126. If parameter 5127 is not used, changes to parameters 5102…5126 take affect only after the drive power is cycled.
- Parameters 5128…5133 provide data about the FBA module currently installed (e.g. component versions and status).

The Parameters section lists the group 51 parameters.

Activate Drive Control Functions – FBA

Fieldbus control of various drive functions requires configuration to:

- Tell the drive to accept fieldbus control of the function.
- Define as a fieldbus input, any drive data required for control.
- Define as a fieldbus output, any control data required by the drive.

The following sections describe, at a general level, the configuration required for each control function. The last column in each table below is deliberately blank. See the user's manual supplied with the FBA module for the appropriate entry.

Start/Stop Direction Control

Using the fieldbus for start/stop/direction control of the drive requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 45: Start/Stop/Direction Control

Drive Parameter		Value	Description	Protocol Reference
1001	**EXT1 COMMANDS**	10 (COMM)	Start/Stop controlled by fieldbus with Ext1 selected.	
1002	**EXT2 COMMANDS**	10 (COMM)	Start/Stop by controlled fieldbus with Ext2 selected.	
1003	**DIRECTION**	3 (REQUEST)	Direction controlled by fieldbus.	

Input Reference Select

Using the fieldbus to provide input reference to the drive requires:

- Drive parameter value set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

NOTE: Multiple references are supported only when using the Daikin Drives profile.

Scaling

Where required, REFERENCES can be scaled. See the Reference scaling in the following sections, as appropriate:

- Daikin drives profile technical data
- Generic profile technical data

Table 46: Input Reference

Drive Parameter		Value	Description	Protocol Reference
1102	**EXT1/EXT2 SEL**	8 (COMM)	Ref. selected by fieldbus. (Required only if 2 references used.)	
1103	**REF1 SEL**	8 (COMM) 9 (COMM+AI1) 10 (COMM*AI1)	Input reference 1 supplied by fieldbus.	
1106	**REF2 SEL**	8 (COMM) 9 (COMM+AI) 10 (COMM*AI)	Input reference 1 supplied by fieldbus. (Required only if 2 references used.)	

System Control

Using the fieldbus for miscellaneous drive control requires:

- Drive parameter values set as defined below.
- Fieldbus controller command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 47: Fieldbus Controller Commands

Drive Parameter		Value	Description	Protocol Reference
1601	**RUN ENABLE**	7 (COMM)	Run enable by fieldbus.	
1604	**FAULT RESET SEL**	8 (COMM)	Fault reset by fieldbus.	
1607	**PARAM SAVE**	1 (SAVE	Saves altered parameters to memory (then value returns to 0).	

Relay Output Control

Using the fieldbus for relay output control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied, binary coded, relay command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 48: Relay Output Control

Drive Parameter		Value	Description	Protocol Reference
1401	**RELAY OUTPUT 1**	35 (COMM) 36 (COMM(-1))	Relay Output 1 controlled by fieldbus.	
1402	**RELAY OUTPUT 2**		Relay Output 2 controlled by fieldbus.	
1403	**RELAY OUTPUT 3**		Relay Output 3 controlled by fieldbus.	
1410[1]	**RELAY OUTPUT 4**		Relay Output 4 controlled by fieldbus.	
1411[1]	**RELAY OUTPUT 5**		Relay Output 5 controlled by fieldbus.	
1412[1]	**RELAY OUTPUT 6**		Relay Output 6 controlled by fieldbus.	
0122	**RO 1-3 STATUS**	Relay 1…3 status.		
0123	**RO 4-6 STATUS**	Relay 4…6 status.		

1. More than 3 relays requires the addition of a relay extension module.

NOTE: Note: Relay status feedback occurs without configuration as defined below.

Analog Output Control

Using the fieldbus for analog output control (e.g. PID setpoint) requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied analog value(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 49: Analog Output Control

Drive Parameter		Value	Description	Protocol Reference
1501	**AO1 CONTENT SEL**	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	—
0135	**COMM VALUE 1**	—		
1502…1505	**AO1 CONTENT MIN… MAXIMUM AO1**	Set appropriate values.	Used for scaling	—
1506	**FILTER AO1**		Filter time constant for AO1.	—
1507	**AO2 CONTENT SEL**	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	—
0136	**COMM VALUE 2**	—		
1508…1511	**AO2 CONTENT MIN… MAXIMUM AO2**	Set appropriate values.	Used for scaling	—
1512	**FILTER AO2**		Filter time constant for AO2.	—

PID Control Setpoint Source

Using the fieldbus for the PID control setpoint requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied setpoint value in the appropriate location. (As defined in Analog output control above.)

Table 50: Setpoint Values

Drive Parameter		Value	Description	Protocol Reference
4010	**SETPOINT SEL**	8 (COMM VALUE 1) 9 (COMM + AI1) 10 (COMM*AI1)	Setpoint is 0135 value (+/-/* AI1)	—

Communication Fault

When using fieldbus control, specify the drive's action if serial communication is lost.

Table 51: Communication Fault

Drive Parameter		Value	Description	Protocol Reference
3018	**COMM FAULT FUNC**	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive response.	—
3019	**COMM FAULT TIME**	Set time delay before acting on a communication loss.	–	

Feedback from the Drive – FBA

Inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration. The following table lists a sample of feedback data. For a complete listing, see all parameters listed in Complete parameter descriptions.

Scaling

To scale the drive parameter values see the Actual value scaling in the following sections, as appropriate:

- Daikin drives profile technical data
- Generic profile technical data

Table 52: Sample of Feedback Data

Drive Parameter		Protocol Reference
0102	SPEED	
0103	FREQ OUTPUT	
0104	CURRENT	
0105	TORQUE	
0106	POWER	
0107	DC BUS VOLT	
0109	OUTPUT VOLTAGE	
0301	FB STATUS WORD – bit 0 (STOP)	
0301	FB STATUS WORD – bit 2 (REV)	
0118	DI1-3 STATUS – bit 1 (DI3)	

Diagnostics – FBA

Fault Handling

The MD5 provides fault information as follows:

- The control panel display shows a fault code and text. See page 74 for a complete description.
- Parameters 0401 LAST FAULT, 0402 PREVIOUS FAULT1 and 0403 PREVIOUS FAULT2 store the most recent faults.
- For fieldbus access, the drive reports faults as a hexadecimal value, assigned and coded according to the DRIVECOM specification. See table below. Not all profiles support requesting fault codes using this specification. For profiles that support this specification, the profile documentation defines the proper fault request process.

Serial Communication Diagnostics

Besides the drive fault codes, the FBA module has diagnostic tools. Refer to the user's manual supplied with the FBA module.

Table 53: Drive Fault Code

Drive Fault Code		Fieldbus Fault Code (DRIVECOM specification)
1	OVERCURRENT	2310h
2	DC OVERVOLT	3210h
3	DEV OVERTEMP	4210h
4	SHORT CIRC	2340h
5	Reserved	FF6Bh
6	DC UNDERVOLT	3220h
7	AI1 LOSS	8110h
8	AI2 LOSS	8110h
9	MOT TEMP	4310h
10	PANEL LOSS	5300h
11	ID RUN FAIL	FF84h
12	MOTOR STALL	7121h
14	EXTERNAL FLT 1	9000h
15	EXTERNAL FLT 2	9001h
16	EARTH FAULT	2330h
17	UNDERLOAD	FF6Ah
18	THERM FAIL	5210h
19	OPEX LINK	7500h
20	OPEX PWR	5414h
21	CURR MEAS	2211h
22	SUPPLY PHASE	3130h
23	ENCODER ERR	7301h
24	OVERSPEED	7310h
25	Reserved	FF80h
26	DRIVE ID	5400h
27	CONFIG FILE	630Fh
28	SERIAL 1 ERR	7510h
29	EFB CONFIG FILE	6306h
30	FORCE TRIP	FF90h
31	EFB 1	FF92h
32	EFB 2	FF93h

Drive Fault Code		Fieldbus Fault Code (DRIVECOM specification)
33	EFB 3	FF94h
34	MOTOR PHASE	FF56h
35	OUTPUT WIRING	FF95h
36	INCOMP SWTYPE	630Fh
101	SERF CORRUPT	FF55h
102	Reserved	FF55h
103	SERF MACRO	FF55h
104	Reserved	FF55h
105	Reserved	FF55h
201	DSP T1 OVERLOAD	6100h
202	DSP T2 OVERLOAD	6100h
203	DSP T3 OVERLOAD	6100h
204	DSP STACK ERROR	6100h
205	Reserved	5000h
206	OMIO ID ERROR	5000h
207	EFB LOAD ERR	6100h
1000	PAR HZRPM	6320h
1001	PAR PFAREFNG	6320h
1002	Reserved (obsolete)	6320h
1003	PAR AI SCALE	6320h
1004	PAR AO SCALE	6320h
1005	PAR PCU 2	6320h
1006	EXT ROMISSING	6320h
1007	PAR FBUSMISSING	6320h
1008	PAR PFAWOSCALAR	6320h
1009	PAR PCU 1	6320h
1010	PAR PFA OVERRIDE	6320h
1011	PAR OVERRIDE PARS	6320h
1012	PAR PFC IO 1	6320h
1013	PAR PFC IO 2	6320h
1014	PAR PFC IO 3	6320h

Generic Profile Technical Data

Overview

The generic profile aims to fulfill the industry-standard drive profile for each protocol (e.g. PROFIdrive for PROFIBUS, AC/DC Drive for DeviceNet).

Control Word

As described earlier in Control interface the CONTROL WORD is the principal means for controlling the drive from a fieldbus system. For specific CONTROL WORD content, see the user's manual provided with the FBA module.

Status Word

As described earlier in Control interface, the contents of the STATUS WORD is status information, sent by the drive to the master station. For specific STATUS WORD content, see the user's manual provided with the FBA module.

Reference

As described earlier in Control interface, the REFERENCE word is a speed or frequency reference.

NOTE: REF2 is not supported by the Generic Drive profiles.

Reference Scaling

REFERENCE scaling is fieldbus type specific. However, at the drive, the meaning of a 100% REFERENCE value is fixed as described in the table below. For a detailed description on the range and scaling of the REFERENCE, see the user's manual supplied with the FBA module.

Table 54: Generic Profile

Reference	Range	Reference Type	Scaling	Remarks
REF	**Fieldbus specific**	**Speed**	-100% = -(par. 9908) 0 = 0 +100 = (par. 9908)	Final reference limited by 1104/1105. Actual motor speed limited by 2001/2002 (speed).
		Frequency	-100% = -(par. 9907) 0 = 0 +100 = (par. 9907)	Final reference limited by 1104/1105. Actual motor speed limited by 2007/2008 (frequency)

Actual Values

As described earlier in Control interface, Actual Values are words containing drive values.

Actual Value Scaling

For Actual Values, scale the feedback integer using the parameter's resolution. (See Complete parameter descriptions section for parameter resolutions.) For example:

Feedback Integer	Parameter Resolution	(Feedback Integer) × (Parameter Resolution) = Scaled Value
1	0.1 mA	1 × 0.1 mA = 0.1 mA
10	0.1%	10 × 0.1% = 1%

Where parameters are in percent, the Complete parameter descriptions section specifies what parameter corresponds to 100%. In such cases, to convert from percent to engineering units, multiply by the value of the parameter that defines 100% and divide by 100%. For example:

Feedback Integer	Parameter Resolution	Value of the Parameter that defines 100%	(Feedback Integer) × (Parameter Resolution) × (Value of 100% Ref.) / 100% = Scaled Value
10	0.1%	1500 rpm[1]	10 × 0.1% × 1500 RPM / 100% = 15 rpm
100	0.1%	500 Hz[2]	100 × 0.1% × 500 Hz / 100% = 50 Hz

1. Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference, and that 9908 = 1500 rpm.
2. Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference, and that 9907 = 500 Hz.

Actual Value Mapping

See the user's manual supplied with the FBA module.

⚠ WARNING

Do not attempt any measurement, parts replacement or other service procedure not described in this manual. Such action will void the warranty, may endanger correct operation, and increase downtime and expense.

⚠ DANGER

All electrical installation and maintenance work described in this chapter should only be undertaken by qualified service personnel. The Safety instructions on the first pages of this manual must be followed.

Diagnostic Displays

The drive detects error situations and reports them using:

- The green and red LED on the body of the drive
- The status LED on the control panel (if the HVAC control panel is attached to the drive)
- The control panel display (if the HVAC control panel is attached to the drive)
- The Fault Word and Alarm Word parameter bits (parameters 0305 to 0309). See Group 03: Actual Signals on page 17.

The form of the display depends on the severity of the error. You can specify the severity for many errors by directing the drive to:

- Ignore the error situation.
- Report the situation as an alarm.
- Report the situation as a fault.

Red – Faults

The drive signals that it has detected a severe error, or fault, by:

- Enabling the red LED on the drive (LED is either steady on or blinking).
- Setting an appropriate bit in a Fault Word parameter (0305 to 0307).
- Overriding the control panel display with the display of a fault code.
- Stopping the motor (if it was on).

The fault code on the control panel display is temporary. Pressing any of the following buttons removes the fault message: MENU, ENTER, UP button or DOWN button. The message reappears after a few seconds if the control panel is not touched and the fault is still active.

Flashing Green – Alarms

For less severe errors, called alarms, the diagnostic display is advisory. For these situations, the drive is simply reporting that it had detected something “unusual.” In these situations, the drive:

- Flashes the green LED on the drive (does not apply to alarms that arise from control panel operation errors).
- Sets an appropriate bit in an Alarm Word parameter (0308 or 0309). See Group 03: Actual Signals for the bit definitions.
- Overrides the control panel display with the display of an alarm code and/or name.

Alarm messages disappear from the control panel display after a few seconds. The message returns periodically as long as the alarm condition exists.

Correcting Faults

The recommended corrective action for faults is:

- Use the Fault listing table below to find and address the root cause of the problem.
- Reset the drive. See Fault Resetting on page 78.

Table 55: Fault Listing

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
1	OVERCURRENT	Output current is excessive. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1). • Faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1).
3	DEV OVERTEMP	Drive heatsink is overheated. Temperature is at or above limit. R1…R4 & R7/R8: 115 °C (239 °F) R5/R6: 125 °C (257 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
4	SHORT CIRC	Fault current. Check for and correct: • A short-circuit in the motor cable(s) or motor. • Supply disturbances.
5	RESERVED	Not used.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for and correct: • Missing phase in the input power supply. • Blown fuse. • Undervoltage on mains.
9	MOT TEMP	Motor is too hot, based on either the drive's estimate or on temperature feedback. • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009).
10	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays HAND or OFF), or • Drive is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections • Parameter 3002 PANEL COMM ERROR. • Parameters in Group 10: START/STOP/DIR and Group 11: REFERENCE SELECT (if drive operation is AUTO).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check for and correct: • Motor connections • Motor parameters 9905…9909
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for and correct: • Excessive load. • Insufficient motor power.
14	EXTERNAL FLT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.

Table 53 continued: Fault Listing

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
16	EARTH FAULT	Possible ground fault detected in the motor or motor cables. The drive monitors for ground faults while the drive is running and while the drive is not running. Detection is more sensitive when the drive is not running and can produce false positives. Possible corrections: • Check for/correct faults in the input wiring. • Verify that motor cable does not exceed maximum specified length. • A delta grounded input power supply and motor cables with high capacitance may result in erroneous error reports during non-running tests. To disable response to fault monitoring when the drive is not running, use parameter 3023 WIRING FAULT. To disable response to all ground fault monitoring, use parameter 3017 EARTH FAULT.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact your local Daikin sales representative.
19	OPEX LINK	Internal fault. A communication-related problem has been detected on the fiber optic link between the OITF and OINT boards. Contact your local Daikin sales representative.
20	OPEX PWR	Internal fault. Low voltage condition detected on OINT power supply. Contact your local Daikin sales representative.
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact your local Daikin sales representative.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for and correct: • Missing mains phase. • Blown fuse.
23	ENCODER ERR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection, or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01.
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED. These are factory set and tested. Contact your local Daikin sales representative if there is a problem. Check for and correct: • Adequacy of motor braking torque. • Applicability of torque control. • Brake chopper and resistor.
25	RESERVED	Not used as of the publication of this manual.
26	DRIVE ID	Internal fault. Configuration Block Drive ID is not valid. Contact your local Daikin sales representative.
27	CONFIG FILE	Internal configuration file has an error. Contact your local Daikin sales representative.
28	SERIAL 1 ERR	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (Group 51 or 53 as appropriate). • Poor connections and/or noise on line.
29	EFB CONFIG FILE	Error in reading the configuration file for the embedded fieldbus.
30	FORCE TRIP	Fault trip forced by the fieldbus. See the fieldbus User's Manual.
31	EFB 1	Fault code reserved for the embedded fieldbus (EFB) protocol application. These codes are not used as of the publication of this manual.
32	EFB 2	
33	EFB 3	
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for and correct: • Motor fault. • Motor cable fault. • Thermal relay fault (if used). • Internal fault.
35	OUTPUT WIRING	Possible power wiring error detected. When the drive is not running it monitors for an improper connection between the drive input power and the drive output. Check for and correct: • Proper input wiring – line voltageis NOT connected to drive output. • The fault can be erroneously declared if the input power is a delta grounded system and motor cable capacitance is large.
36	INCOMP SWTYPE	The drive cannot use the software. • Internal Fault. • The loaded software is not compatible with the drive. • Call support representative.
37	CB OVERTEMP	Drive control board is overheated. Check for and correct: • Excessive ambient temperatures • Fan failure. • Obstructions in the air flow.

Table 53 continued: Fault Listing

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
101	SERF CORRUPT	Error internal to the drive. Contact your local Daikin sales representative and report the error number.
102	RESERVED	
103	SERF MACRO	
104	RESERVED	
105	RESERVED	
201	DSP T1 OVERLOAD	Error in the system. Contact your local Daikin sales representative and report the error number.
202	DSP T2 OVERLOAD	
203	DSP T3 OVERLOAD	
204	DSP STACK ERROR	
205	RESERVED (obsolete)	
206	OMIO ID ERROR	
207	EFB LOAD ERR	
1000	PAR HZRPM LIMITS	Parameter values are inconsistent. Check for any of the following: • 2001* MINIMUM SPEED > 2002* MAXIMUM SPEED. • 2007* MINIMUM FREQ > 2008* MAXIMUM FREQ. • 2001* MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50) • 2002* MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50) • 2007* MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50) • 2008* MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50) *These are factory set and tested. Contact your local Daikin sales representative if there is a problem.
1001	PAR PFAREFNG	Parameter values are inconsistent. Check for the following: • 2007 MINIMUM FREQ is negative, when 8123 PFA ENABLE is active.
1002	RESERVED (Obsolete)	
1003	PAR AI SCALE	Parameter values are inconsistent. Check for any of the following: • 1301* AI 1 MIN > 1302 AI 1 MAX. • 1304* AI 2 MIN > 1305 AI 2 MAX. *Not used with MicroTech III.
1004	PAR AO SCALE	Parameter values are inconsistent. Check for any of the following: • 1504* AO 1 MIN > 1505 AO 1 MAX. • 1510* AO 2 MIN > 1511 AO 2 MAX. *Not used with MicroTech III.
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check for the following: • 1.1 < (9906 MOTOR NOM CURR * 9905 MOTOR NOM VOLT * 1.73 / P_n) < 3.0 • Where: P_n = 1000 * 9909 MOTOR NOM POWER (if units are kW) or P_n = 746 * 9909 MOTOR NOM POWER (if units are HP, e.g. in US)
1006	EXT ROMISSING	Parameter values are inconsistent. Check for the following: • Extension relay module not connected and • 1410…1412 RELAY OUTPUTS 4…6 have non-zero values.
1007	PAR FBUSMISSING	Parameter values are inconsistent. Check for and correct: • A parameter is set for fieldbus control (e.g. 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFAWOSCALAR	Parameter values are inconsistent – 9904 MOTOR CTRL MODE must be = 3 (SCALAR: SPEED), when 8123 PFA ENABLE is activated.
1009	PAR PCU1	Parameter values for power control are inconsistent: Improper motor nominal frequency or speed. Check for both of the following: • 1 < (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED < 16 • 0.8 < 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor Poles) < 0.992
1010	PAR PFA OVERRIDE	Both the override mode and PFA are activated at the same time. These modes are mutually incompatible, because PFA interlocks cannot be observed in the override mode.
1011	PAR OVERRIDE PARS	Override is enabled, but parameters are incompatible. Verify that 1701 is not zero, and (depending on 9904* value) 1702* or 1703* is not zero. *Not used with MicroTech III.
1012	PAR PFA IO 1	IO configuration is not complete – not enough relays are parameterized to PFA. Or, a conflict exists between Group 14, parameter 8117*, NR OF AUX MOT, and parameter 8118*, AUTOCHNG INTERV. *Not used with MicroTech III.
1013	PAR PFA IO 2	IO configuration is not complete – the actual number of PFA motors (parameter 8127, MOTORS) does not match the PFA motors in Group 14* and parameter 8118* AUTOCHNG INTERV. *Not used with MicroTech III.
1014	PAR PFA IO 3	IO configuration is not complete – the drive is unable to allocate a digital input (interlock) for each PFA motor (parameters 8120* INTERLOCKS and 8127* MOTORS). *Not used with MicroTech III.

Fault Resetting

The MD5 can be configured to automatically reset certain faults. Refer to parameter Group 31: Automatic Reset on page 33.

⚠ WARNING

If an external source for start command is selected and it is active, the MD5 may start immediately after fault reset.

Flashing Red Led

To reset the drive for faults indicated by a flashing red LED:

- Turn off the power for 5 minutes.

Red LED

To reset the drive for faults indicated by a red LED (on, not flashing), correct the problem and do one of the following:

- From the control panel, press RESET
- Turn off the power for 5 minutes.

Depending on the value of 1604, FAULT RESET SELECT, the following could also be used to reset the drive:

• Digital input

• Serial communication

When the fault has been corrected, the motor can be started.

History

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402…0411) to aid in troubleshooting a problem. For example, parameter 0404 stores the motor speed at the time of the fault.

To clear the fault history (all of the Group 04, Fault History parameters):

1. Using the control panel in Parameters mode, select parameter 0401.
2. Press EDIT.
3. Press UP and Down simultaneously.
4. Press SAVE.

Correcting alarms

The recommended corrective action for alarms is:

- Determine if the Alarm requires any corrective action (action is not always required).
- Use Alarm listing below to find and address the root cause of the problem.

Alarm Listing

The following table lists the alarms by code number and describes each.

Table 56: Alarms by Code Numbers

Alarm Code	Display	Description
2001	**OVERCURRENT**	Current limiting controller is active. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1). • Faulty motor, motor cables or connections.
2002	**OVERVOLTAGE**	Over voltage controller is active. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1).
2003	**UNDERVOLTAGE**	Under voltage controller is active. Check for and correct: • Undervoltage on mains.
2004	**DIR LOCK**	The change in direction being attempted is not allowed. Either: • Do not attempt to change the direction of motor rotation, or
2008	**PANEL LOSS**	Panel communication is lost and either: • Drive is in local control mode (the control panel displays HAND or OFF), or • Drive is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections • Parameters in Groups 10 START/STOP/DIR and 11: REFERENCE SELECT (if drive operation is AUTO).
2009	**DEVICE OVERTEMP**	Drive heatsink is hot. This alarm warns that a DEVICE OVERTEMP fault may be near. R1…R4 & R7/R8: 100 °C (212 °F) R5/R6: 110 °C (230 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.

Table 54 continued: *Alarms by Code Numbers*

Fault Code	Fault Name In Panel	Description and Recommended Corrective Action
2010	MOT OVERTEMP	Motor is hot, based on either the drive's estimate or on temperature feedback. This alarm warns that a Motor Underload fault trip may be near. Check: • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check: • Motor and drive ratings match (motor is NOT undersized for the drive)
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013 (note 1)	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. • To control automatic reset, use parameter Group 31: Automatic Reset on page 33.
2014 (note 1)	AUTOCHANGE	This alarm warns that the PFA autochange function is active. • To control PFA, use parameter Group 81: PFA Control on page 41
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start the following: • Any motor (when Autochange is used), • The speed regulated motor (when Autochange is not used).
2016	Reserved	
2017	OFF BUTTON	Note 1.
2018 (note 1)	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. • To control PID sleep, use parameters 4022*…4026* or 4122*…4126.* *Not used with MicroTech II.
2019	ID RUN	Performing ID run.
2020	OVERRIDE	This alarm warns that the Override function is active, which may start the motor.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. • To control Start Enable 1 function, use parameter 1608. To correct, check: • Digital input configuration. • Communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. • To control Start Enable 2 function, use parameter 1609. To correct, check: • Digital input configuration. • Communication settings.
2023	EMERGENCY STOP	Emergency stop activated.
2024	ENCODER ERROR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection, or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01.
2025	FIRST START	Signals that a the drive is performing a First Start evaluation of motor characteristics. This is normal the first time the motor is run after motor parameters are entered or changed. See parameter 9910 (MOTOR ID RUN) for a description of motor models.
2026	RESERVED	Not used.
2027	USER LOAD CURVE	This alarm warns that the condition defined by parameter 3701 USER LOAD C MODE has been valid longer that half of the time defined by 3703 USER LOAD C TIME. Contact your local Daikin sales representative if there is a problem.
2028	START DELAY	Shown during the Start delay. See parameter 2113 START DELAY. Contact your local Daikin sales representative if there is a problem.

NOTE: Even when the relay output is configured to indicate alarm conditions (e.g. parameter 1401 RELAY OUTPUT 1 = 5 (ALARM) or 16 (FLT/ALARM)), this alarm is not indicated by a relay output.

⚠ WARNING

Read Safety on page 1-3 before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance Intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by Daikin.

Table 57: Maintenance Intervals

Maintenance	Application	Interval	Instruction
Check/replace R7/R8 enclosure inlet air filter	R7/R8 UL type 12 enclosures	Check every 3 months. Replace as needed.	Frame Sizes R7/R8 – UL type 12 enclosure inlet air filter on page 81
Check/replace R7/R8 enclosure exhaust air filter.	R7/R8 UL type 12 enclosures	Check every 6 months. Replace as needed.	Frame Sizes R7/R8 – UL type 12 enclosure exhaust filters on page 81
Check and clean heatsink.	All	Depends on the dustiness of the environment (every 6…12 months)	See Heatsink below.
Replace drive module fan.	Al	Every six years	See Drive module fan replacement on below.
Replace drive module fan.	UL type 12 enclosures	Every three years.	See Enclosure fan replacement – UL Type 12 enclosures on page 81.
Change capacitor.	Frame sizes R5 and R6	Every ten years	See Capacitors on page 81.
Replace battery in the Assistant control panel	All	Every ten years	See Control panel on page 81.

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a “normal” environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from drive.
2. Remove the cooling fan (see Figure 12 and Figure 13).
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.
4. Replace the cooling fan.
5. Restore power.

NOTE: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

Drive Module Fan Replacement

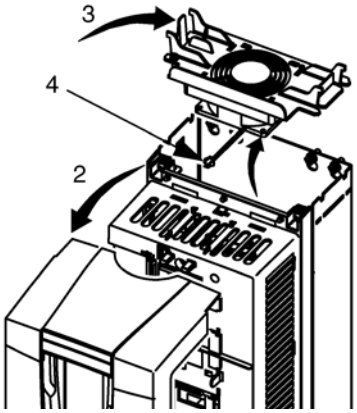
The drive module fan cools the heatsink. Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from Daikin. Do not use other than Daikin specified spare parts.

Frame Sizes R1—R4

To replace the fan:

1. Remove power from drive.
2. Remove drive cover.
3. For Frame Size:
   - — R1, R2: Press together the retaining clips on the fan cover sides, and lift.
   - — R3, R4: Press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.

Figure 12: Drive Module Fan Replacement, R1–R4

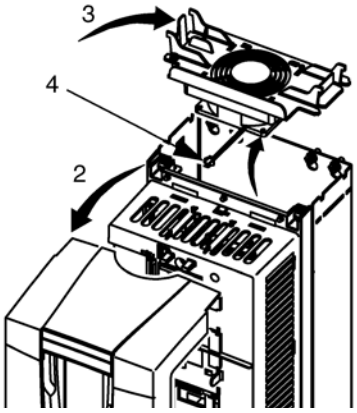


Frame Sizes R5 and R6

To replace the fan:

1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Remove the fan:
   - R5: Swing the fan out on its hinges.
   - R6: Pull the fan out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.

Figure 13: Drive Module Fan Replacement, R5–R6



Frame Sizes R7 and R8

Refer to the installation instructions supplied with the fan kit. Enclosure fan replacement – UL Type 12 enclosures UL type 12 enclosures include an additional fan (or fans) to move air through the enclosure.

Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35,000…90,000 hours depending on drive loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. Capacitor failure is usually followed by a input power fuse failure or a fault trip. Contact Daikin if capacitor failure is suspected. Replacements for frame size R5 and R6 are available from Daikin. Do not use other than Daikin specified spare parts.

Control Panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is only used in Assistant control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

NOTE: The battery is NOT required for any control panel or drive function, except the clock.

Ratings

By type code, the table below provides ratings for the MD5 adjustable speed AC drive, including:

- IEC ratings
- NEMA ratings (shaded columns)
- Frame size

Ratings, 208…240 volt drives

Abbreviated column headers are described in Symbols on page 83.

Table 58: Ratings, 208…240 volt drives

Valid up to 40°C (104 °F)		Frame Size
$I2_n$ A	P_n HP	
Three-phase supply voltage, 208…240 V		
4.6	1.0	R1
6.6	1.5	R1
7.5	2.0	R1
11.8	3.0	R1
16.7	5.0	R1
24.2	7.5	R2
30.8	10.0	R2
46.2	15.0	R3
59.4	20.0	R3
74.8	25.0	R4
88.0	30.0	R4
114	40.0	R4
143	50.0	R6
178	60.0	R6
221	75.0	R6
248	100	R6

Ratings, 380…480 volt drives

Abbreviated column headers are described in Symbols on page 83.

Table 59: Ratings, 380…480 volt drives

Valid up to 40°C (104 °F)		Frame Size
$I2_n$ A	P_n HP	
Three-phase supply voltage, 380…480 V		
3.3	1.5	R1
4.1	2	R1
6.9	3	R1
8.8	5	R1
11.9	7.5	R1
15.4	10	R2
23	15	R2
31	20	R3
38	25	R3
44	30	R3
44	30	R4
59	40	R4
72	50	R4
77	60	R4
96	75	R4
77	60	R5
96	75	R5
124	100	R5

Ratings, 500…600 volt drives

Abbreviated column headers are described in Symbols below.

Table 60: Ratings, 500…600 volt drives

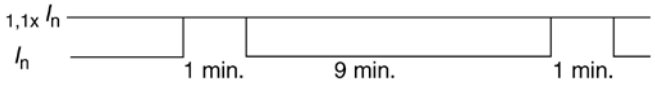
Type Code	Normal Use		Frame Size
ACH550-xx- see below	$I2_n$ A	P_n HP	
Three-phase supply voltage, 500…600 V			
-02A7-6	2.7	2	R2
-03A9-6	3.9	3	R2
-06A1-6	6.1	5	R2
-09A0-6	9	7.5	R2
-011A-6	11	10	R2
-017A-6	17	15	R2
-022A-6	22	20	R3
-027A-6	27	25	R3
-032A-6	32	30	R4
-041A-6	41	40	R4
-052A-6	52	50	R4
-062A-6	62	60	R4
-077A-6	77	75	R6
-099A-6	99	100	R6
-125A-6	125	125	R6
-144A-6	144	150	R6

Symbols

Typical ratings:

Normal use (10% overload capability)

$I2_n$ continuous rms current. 10% overload is allowed for one minute in ten minutes.



P_n typical motor power in normal use. The kilowatt power ratings apply to most IEC, 4-pole motors. The Horsepower ratings apply to most 4-pole NEMA motors.

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

NOTE: The ratings apply in ambient temperature of 40 °C (104 °F).

Derating

The load capacity (current and power) decreases for certain situations, as defined below. In such situations, where full motor power is required, oversize the drive so that the derated value provides sufficient capacity.

For example, if your application requires 15.4 A of motor current and a 12 kHz switching frequency, calculate the appropriate drive size requirement as follows:

The minimum size required = 15.4 A / 0.80 = 19.25 A

Where: 0.80 is the derating for 12 kHz switching frequency (see Switching frequency derating below).

Referring to $I2_n$ in the ratings tables (page 1-299), the following drives exceed the $I2_n$ requirement of 19.25 A: MD5-UH-023A-4, or MD5-UH-024A-2

Temperature Derating

In the temperature range +40 °C…50 °C (+104 °F…122 °F) the rated output current is decreased 1% for every 1 °C (1.8 °F) above +40 °C (+104 °F). Calculate the output current by multiplying the current given in the rating table by the derating factor.

Example: If the ambient temperature is 50 °C (+122 °F) the derating factor is 100% - 1%/°C x 10 °C = 90% or 0.90.

The output current is then 0.90 x $I2_n$.

Altitude Derating

In altitudes from 1000…4000 m (3300…13,200 ft) above sea level, the derating is 1% for every 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local Daikin distributor or office for further information.

Single Phase Supply Derating

For 208…240 Volt series drives, a single phase supply can be used. In that case, the derating is 50%.

Control connections

Control Connection Specifications

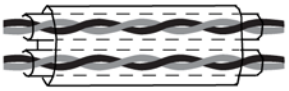
Table 61: Control Connection Specifications

Analog Inputs and Outputs	See Table 60: Drive Control Terminal Descriptions on page 86.
Digital Inputs	Digital input impedance 1.5 kΩ. Maximum voltage for digital inputs is 30 V.
Relays (Digital Outputs)	• Max. contact voltage: 30 V DC, 250 V AC • Max. contact current / power: 6 A, 30 V DC; 1500 VA, 250 V AC • Max. continuous current: 2 A rms (cos φ = 1), 1 A rms (cos φ = 0.4) • Minimum load: 500 mW (12 V, 10 mA) • Contact material: Silver-nickel (AgN)| • Isolation between relay digital outputs, test voltage: 2.5 kV rms, 1 minute

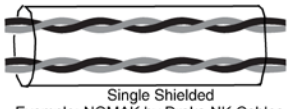
Control Cables

General Recommendations

Use multi-core cables with a braided copper wire screen, temperature rated at 60 °C (140 °F) or above:



Double Shielded
Example: JAMAK by Draka NK Cables



Single Shielded
Example: NOMAK by Draka NK Cables

At the drive end, twist the screen together into a bundle not longer than five times its width and connected to terminal X1-1 (for digital and analog I/O cables) or to either X1-28 or X1-32 (for RS485 cables).

Route control cables to minimize radiation to the cable:

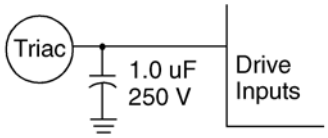
- Route as far away as possible from the input power and motor cables (recommend at least 20 cm [8 in] where practical).
- Where control cables must cross power cables make sure they are at an angle as near 90° as possible.
- Stay at least 20 cm (8 in) from the sides of the drive where practical.

Use care in mixing signal types on the same cable:

- Do not mix analog and digital input signals on the same cable.
- Run relay-controlled signals as twisted pairs (especially if voltage > 48 V). Relaycontrolled signals using less than 48 V can be run in the same cables as digital input signals.

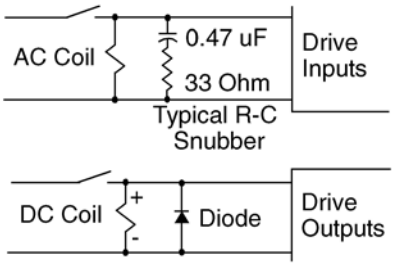
NOTE: Never mix 24 VDC and 115/230 VAC signals in the same cable.

Triacs used as sources for drive inputs, may have excessive leakage current in the OFF state, enough to read as ON to drive inputs. Driving two or more inputs, divides the leakage current, reducing or eliminating the problem. An alternative is to add a small capacitive load – see figure.



⚠ WARNING

Relay coils generate noise spikes in response to steps in applied power. To avoid drive damage from such spikes, all AC relay coils mounted across drive inputs require R-C snubbers, and all DC relay coils mounted across drive outputs require diodes – see figure.



Analog Cables

Recommendations for analog signal runs:

- Use double shielded, twisted pair cable.
- Use one individually shielded pair for each signal.
- Do not use a common return for different analog signals.

Digital Cables

Recommendation for digital signal runs: A double shielded cable is the best alternative, but single-shielded, twisted, multi-pair cable is also usable.

Control Panel Cable

If the control panel is connected to the drive with a cable, use only Category 5 Patch ethernet cable.

Drive's Control Connection Terminals

The following table provides specifications for the drive's control terminals

Frame Size	Control			
	Maximum Wire Size		Torque	
	mm2	AWG	Nm	lb-ft
All	1.5	16	0.4	0.3

Control Terminal Descriptions

The following full-page diagram provides a general description of the control terminals on the drive. For specific application details, see the Application Macros on page 9.

NOTE: Terminals 3, 6, and 9 are at the same potential.

For safety reasons the fault relay signals a "fault" when the MD5 is powered down.

Table 62: Drive Control Terminal Descriptions

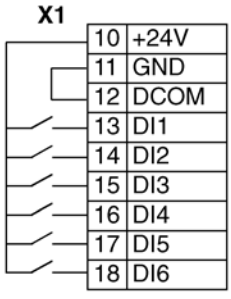
	X1		Drive Control Terminal Description
Analog I/O	1	SCR	Terminal for signal cable screen. (Connected internally to chassis ground.)
	2	AI1	Analog input channel 1, programmable. Default[2] = external reference. Resolution 0.1%, accuracy ±1%.
			J1:AI1 OFF: 0(2)…10 V (Ri = 312 kΩ) or, for OFF for ON
			J1:AI1 ON: 0(4)…20 mA (Ri = 100 Ω)
	3	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 MΩ).
	4	+10 V	Potentiometer reference source: 10 V ±2%, max. 10 mA (1kΩ < R < 10kΩ).
	5	AI2	Analog input channel 2, programmable. Default[2] = PID feedback. Resolution 0.1%, accuracy ±1%.
			J1:AI2 OFF: 0(2)…10 V (Ri = 312 kΩ) or, for OFF for ON
			J1:AI2 ON: 0(4)…20 mA (Ri = 100 Ω)
	6	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 MΩ).
	7	AO1	Analog output, programmable. Default[2] = frequency. 0…20 mA (load < 500 Ω).
	8	AO2	Analog output, programmable. Default[2] = current. 0…20 mA (load < 500 Ω).
	9	AGND	Analog output circuit common (connected internally to chassis gnd. through 1 MΩ).
Digital Inputs[1]	10	+24V.	Auxiliary voltage output 24 VDC / 250 mA (reference to GND), short circuit protected
	11	GND	Auxiliary voltage output common (connected internally as floating).
	12	DCOM	Digital input common. To activate a digital input, there must be ≥+10 V (or ≤-10 V) between that input and DCOM. The 24 V may be provided by the MD5 (X1-10) or by an external 12…24 V source of either polarity.
	13	DI1	Digital input 1, programmable. Default[2] = start/stop.
	14	DI2	Digital input 2, programmable. Default[2] = not configured.
	15	DI3	Digital input 3, programmable. Default[2] = constant (preset) speed.
	16	DI4	Digital input 4, programmable. Default[2] = safety interlock.
	17	DI5	Digital input 5, programmable. Default[2] = not configured.
	18	DI6	Digital input 6, programmable. Default[2] = not configured.
Relay Outputs	19	RO1C	Relay output 1, programmable. Default[2] = Ready Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	20	RO1A	
	21	RO1B	
	22	RO2C	Relay output 2, programmable. Default2 = Running Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	23	RO2A	
	24	RO2B	
	25	RO3C	Relay output 3, programmable. Default2 = Fault (-1) Maximum: 250 VAC / 30 VDC, 2 A Minimum: 500 mW (12 V, 10 mA)
	26	RO3A	
	27	RO3B	

1 Digital input impedance 1.5 kΩ. Maximum voltage for digital inputs is 30 V.

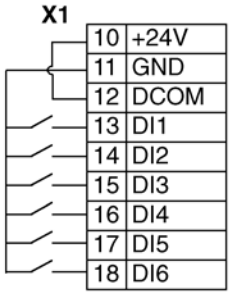
2 Default values depend on the macro used. Values specified are for the HVAC default macro. See Application Macros on page 9**.**

You can wire the digital input terminals in either a PNP or NPN configuration.

PNP connection (source)



NPN connection (sink)



Serial Communications

Terminals 28…32 provide RS485 serial communication connections used to control or monitor the drive from a fieldbus controller. See Embedded Fieldbus on page 45 for details.

Ambient Conditions

The following table lists the MD5 environmental requirements.

Table 63: Ambient Environment Requirements

	Installation Site	Storage and Transportation in the protective package
Altitude	• 0…1000 m (0…3,300 ft) • 1000…2000 m (3,300…6,600 ft) if P_n and I2 derated 1% every 100 m above 1000 m (300 ft above 3,300 ft)	
Ambient temperature	• Min. -15 ºC (5 ºF) – no frost allowed • Max. (fsw = 1 or 4) 40 ºC (104 ºF); 50 ºC (122 ºF) if P_n and I2 derated to 90% • Max. (fsw = 8) 40 ºC (104 ºF) if P_n and I2 derated to 80% • Max. (fsw = 12) 30 ºC (86 ºF) if P_n and I2 derated to 65% (to 50% for 600 V, R4 frame sizes, that is for MD5-xx-032A-6…MD5-xx- 062A-6).	-40…70 ºC (-40…158 ºF)
Relative humidity	< 95% (non-condensing)	
Contamination Levels (IEC 721-3-3)	• No conductive dust allowed. • The MD5 should be installed in clean air according to enclosure classification. • Cooling air must be clean, free from corrosive materials and free from electrically conductive dust. • Chemical gases: Class 3C2 • Solid particles: Class 3S2	**Storage** • No conductive dust allowed. • Chemical gases: Class 1C2 • Solid particles: Class 1S2 **Transportation** • No conductive dust allowed. • Chemical gases: Class 2C2 • Solid particles: Class 2S2

Applicable Standards

Drive compliance with the following standards is identified by the standards “marks” on the type code label.

Table 64: Applicable Standards

Mark	Applicable Standards	
CE	EN 50178 (1997)	Electronic equipment for use in power installations
	EN 60204-1 (1997 + corrigendum Sep. 1998)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. Provisions for compliance: The final assembler of the machine is responsible for installing: • An emergency-stop device • A supply disconnecting device
	EN 60529 (1991 + corrigendum May 1993 + amendment A1:2000)	Degrees of protection provided by enclosures (IP code)
	EN 61800-3 (1996) + Amendment A11 (2000)	EMC product standard including specific test methods
C-tick	EN 61800-3 (1996) + Amendment A11 (2000)	EMC product standard including specific test methods
c ETL US LISTED Intertek	UL 508C and C22.2 No. 14	UL Standard for Safety, Power Conversion Equipment, second edition and CSA Standard for Industrial Control Equipment
CSA	C22.2 No. 14	CSA Standard for Industrial Control Equipment

Compliance is valid with the following provisions:

- The motor and control cables are chosen as specified in this manual.
- The installation rules of this manual are followed.

UL Markings

When a UL mark is attached to the MD5 AC drive, it verifies that the drive follows the provisions of UL 508C.

When a CSA mark is attached to the MD5 AC drive, it verifies that the drive follows the provisions of C22.2 No. 14.

Daikin Applications

Parameter Settings:

The MD5 VFD has been made to Daikin specifications. All factory installed MD5 VFDs with MicroTech III controls are also factory configured and started. Table 63 lists the parameters that have been specifically configured for Daikin or may need owner adjustment as described in this manual.

- "HVAC Default" settings mentioned in the Table 63 note is the vendor default if Parameter 9902 is set as shown.
- "Daikin Settings" are the recommended settings for Daikin units.
- No other parameters should be needed or adjusted.

⚠ WARNING

Unintended Equipment Operation

• Modifying or changing parameters whose function is not described in this manual will affect drive controller operation. Some register changes will take effect as soon as they are entered.

• Do not modify or change parameters whose function is not described in this instruction bulletin.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Table 63: Parameter Settings

MD5 Parameters		Unit	RoofPak & Self C	Maverick II	Maverick II	RoofPak	Maverick II & Rebel
#	Name		SAF, RAF & EAF	SAF	EAF	Ener Rec Wheel	Ener Rec Wheel
9802	COMM PROT SEL		STD MODBUS	STD MODBUS	STD MODBUS	STD MODBUS	STD MODBUS
9901	LANGUAGE		ENGLISH	ENGLISH	ENGLISH	ENGLISH	ENGLISH
9902	APPLIC MARCO		HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT
9905	MOTOR NOM VOLT	V	575	575	575	575	575
9906	MOTOR NOM CURR	A	57	28	4	2	0.4
9907	MOTOR NOM FREQ	Hz	60	60	60	60	60
9908	MOTOR NOM SPEED	rpm	1775	1775	1140	1775	1775
9909	MOTOR NOM POWER	hp	60	30	3	1	0.2
1001	EXT1 COMMANDS		COMM	COMM	COMM	COMM	COMM
1102	EXT1/EXT2 SEL		EXT1	EXT1	EXT1	EXT1	EXT1
1103	REF1 SELECT		COMM	COMM	COMM	COMM	COMM
1104	REF1 MIN	Hz	0	0	0	0	0
1105	REF1 MAX	Hz	60	60	60	60	60
1106	REF2 SELECT		KEYPAD	KEYPAD	KEYPAD	KEYPAD	KEYPAD
1201	CONST SPEED SEL		NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL
1601	RUN ENABLE		COMM	COMM	COMM	COMM	COMM
1604	FAULT RESET SEL		COMM	COMM	COMM	COMM	COMM
1607	PARAM SAVE		DONE	DONE	DONE	DONE	DONE
1608	START ENABLE 1		COMM	COMM	COMM	COMM	COMM
1611	PARAMETER VIEW		DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT
2101	START FUNCTION		SCALAR FLYST	SCALAR FLYST	SCALAR FLYST	SCALAR FLYST	SCALAR FLYST
2202	ACCELER TIME 1	s	60	60	60	60	60
2203	DECELER TIME 1	s	60	60	60	60	60
2605	U/F RATIO		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
3003	EXTERNAL FAULT 1		DI 2(INV)	NOT SEL	NOT SEL	NOT SEL	NOT SEL
3009	BREAK POINT FREQ	Hz	45	45	45	45	45
3101	NUMBER TRIALS		5	5	5	5	5
3103	DELAY TIME	s	3	3	3	3	3
3104	AR OVERCURRENT		ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
3404	OUTPUT1 DSP FORM		DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
3405	OUTPUT1 UNIT		%	Hz	Hz	Hz	Hz
3415	SIGNAL3 PARAM		AI 1	SPEED	SPEED	SPEED	SPEED
3418	OUTPUT3 DSP FORM		+0.0	DIRECT	DIRECT	DIRECT	DIRECT
3421	OUTPUT3 MAX		44ma	1800 rpm	1800 rpm	1800 rpm	1800 rpm
4201	GAIN		The Daikin software version [will grow over time]				
4202	INTEGRATION TIME	s	451	370	468	165	284
5302	EFB STATION ID		SAF=1, R/EAF=2	1	2	3	3
5303	EFB BAUD RATE		192	192	192	192	192
5304	EFP PARITY		8 NONE 2	8 NONE 2	8 NONE 2	8 NONE 2	8 NONE 2
5306	EFB OK MESSAGES		Usually a big number that continues to grow				
5307	EFB CRC ERRORS		0	0	0	0	0
5308	EFB UART ERRORS		Usually a small number that grows slowly unless there is a MicroTech III communication problem				
5309	EFB STATUS		ON-LINE	ON-LINE	ON-LINE	ON-LINE	ON-LINE
8120	INTERLOCKS		NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL
1002	EXT2 COMMANDS		NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL
1301	MINIMUM AI1	%	MicroTech III limits minimum speed to 20 hz				
1302	MAXIMUM AI1	%	MicroTech III limits maximum speed to 60 hz				
3416	SIGNAL3MIN		0%	0 rpm	0 rpm	0%	0 rpm
3419	OUTOUT3UNIT		mA	rpm	rpm	rpm	rpm
3420	OUTPUT3MIN	mA	0	0	0	0	0

Vary depending on motor nameplate voltage and hp
These values vary depending on the application
Not important, will be HVAC default values

MicroTech III Control Parameters:

The MD5 will be factory configured to work with MicroTech III Controls and factory tested. The downloaded parameters have a high probability of being fully correct if the following parameters are set.

- Parameter 9802 states: “STD MODBUS”.
- Parameter 1001, 1103, 1601, 1604 and 1608 state: “COMM”.
- Parameter 5302 = address 1, 2 or 3 as required by the application.
- Parameter 5303 = “192” buad rate (19.2 K Bytes/second).
- Parameter 5304 = “8 NONE 2”.
- Parameter 5306 “EFB OK MESSAGES” will count up for every correct message received and continue to do so.
- Parameter “EFB STATUS” shows “ON-LINE”.
- Parameter 8120 states “NOT SEL”. If “DI4” is seen. This must be changed to = “NOT SEL”.
- Parameter 1002 states “NOT SEL”. Change to = “NOT SEL” if needed.

Factory Communications Troubleshooting Instructions

Reference: Diagnostics on page 74.

Possible Faults

- Loose wires. Difficult to discover, check mechanical tightness of all terminal connection points. Other faults specifically described below may be observed.
- Incorrect connections (including swapped wires).
- Bad grounding. Check for excessive EFB errors; improve communications cable installation as required.
- MicroTech III does not properly recognize the difference between the SAF, RAF and EAF condenser fan or energy recovery VFDs if the values for both 5307 and 5308 increase for each error transmission attempt.
- MicroTech III communications is not working if parameters 5306, 5307 or 5308 do not continually increment their count.
- The Modbus communication port is not working (broken or controller is OFF) if ALARM 2021 is flashing on the kepad screen, parameter 5306 is not increasing its count, or parameter 5309 “EFB STATUS” shows on the keypad as “IDLE”.
- The Daikin Factory Test Operator will change any Group 99 values to match the installed motor nameplates as required for Rooftop and Self-Contained units. Maverick units have specific allowed motor amp values that are entered into the VFD matching the design specification.

Figure 14: MD5 Maverick II — Supply Fan, Exhaust Fan and Energy Recovery Wheel

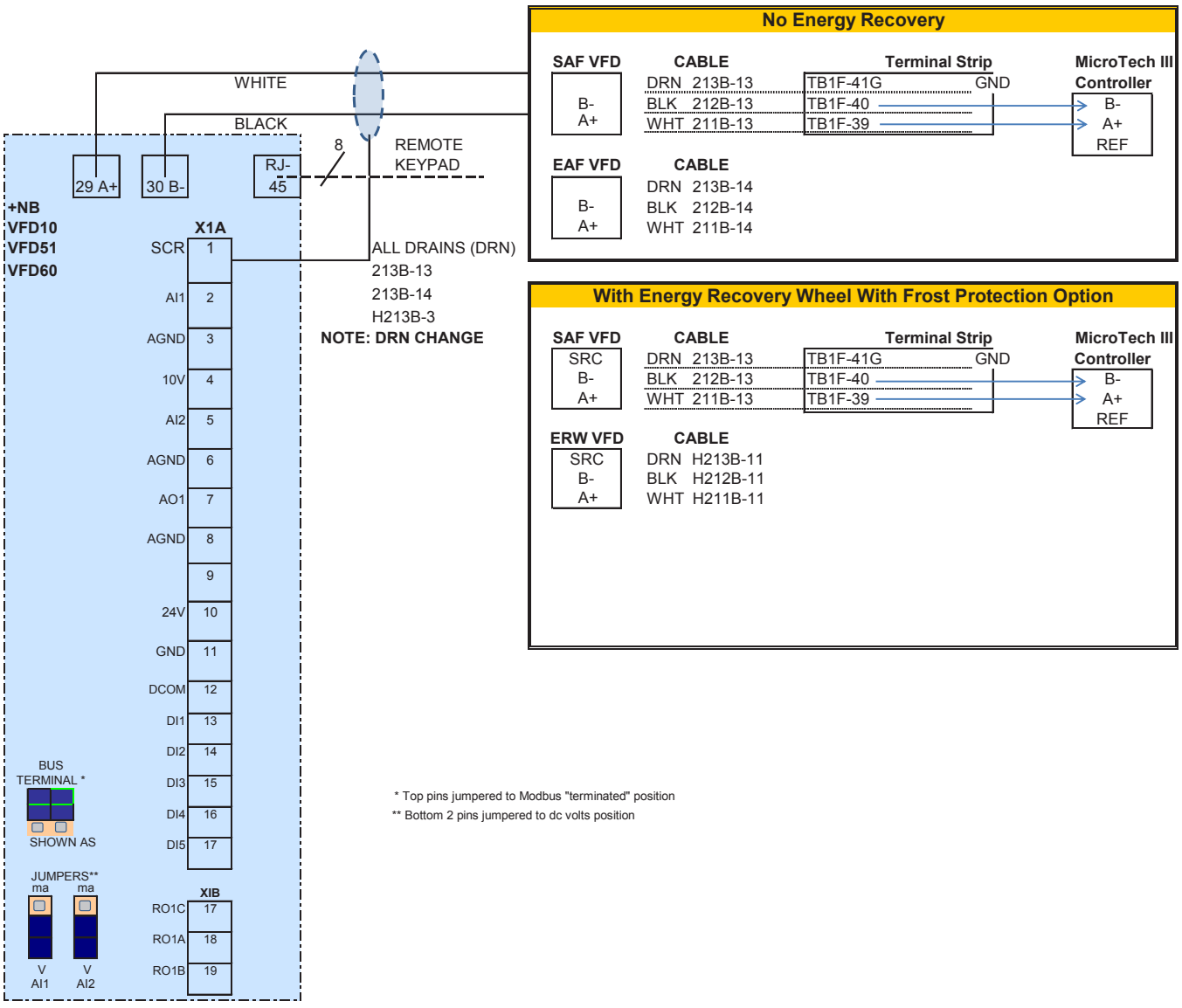


Figure 15: MD5 RoofPak and Self-Contained Air Conditioner Supply Air Fan

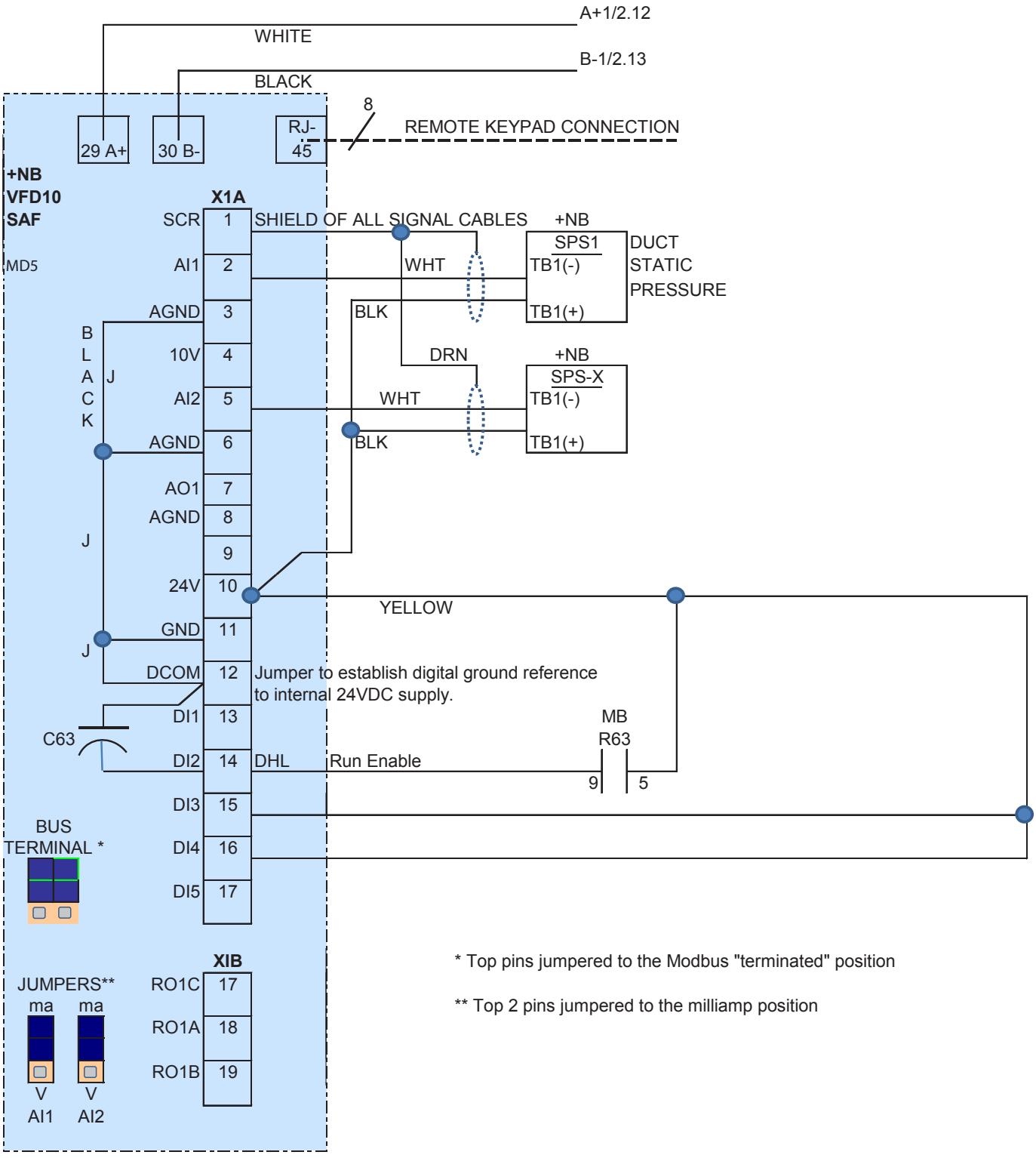


Figure 16: MD5 RoofPak Condenser Fan Speed Control

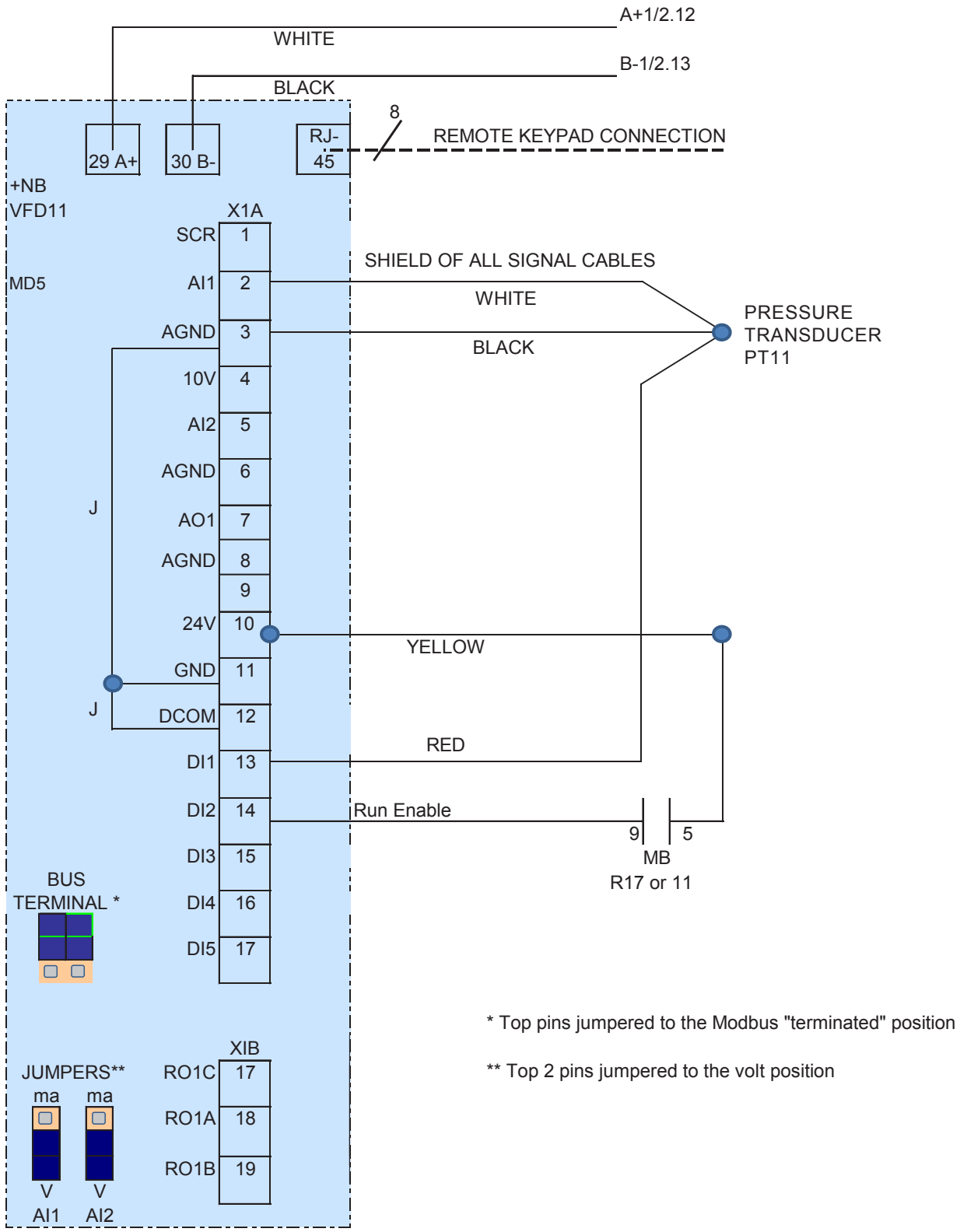
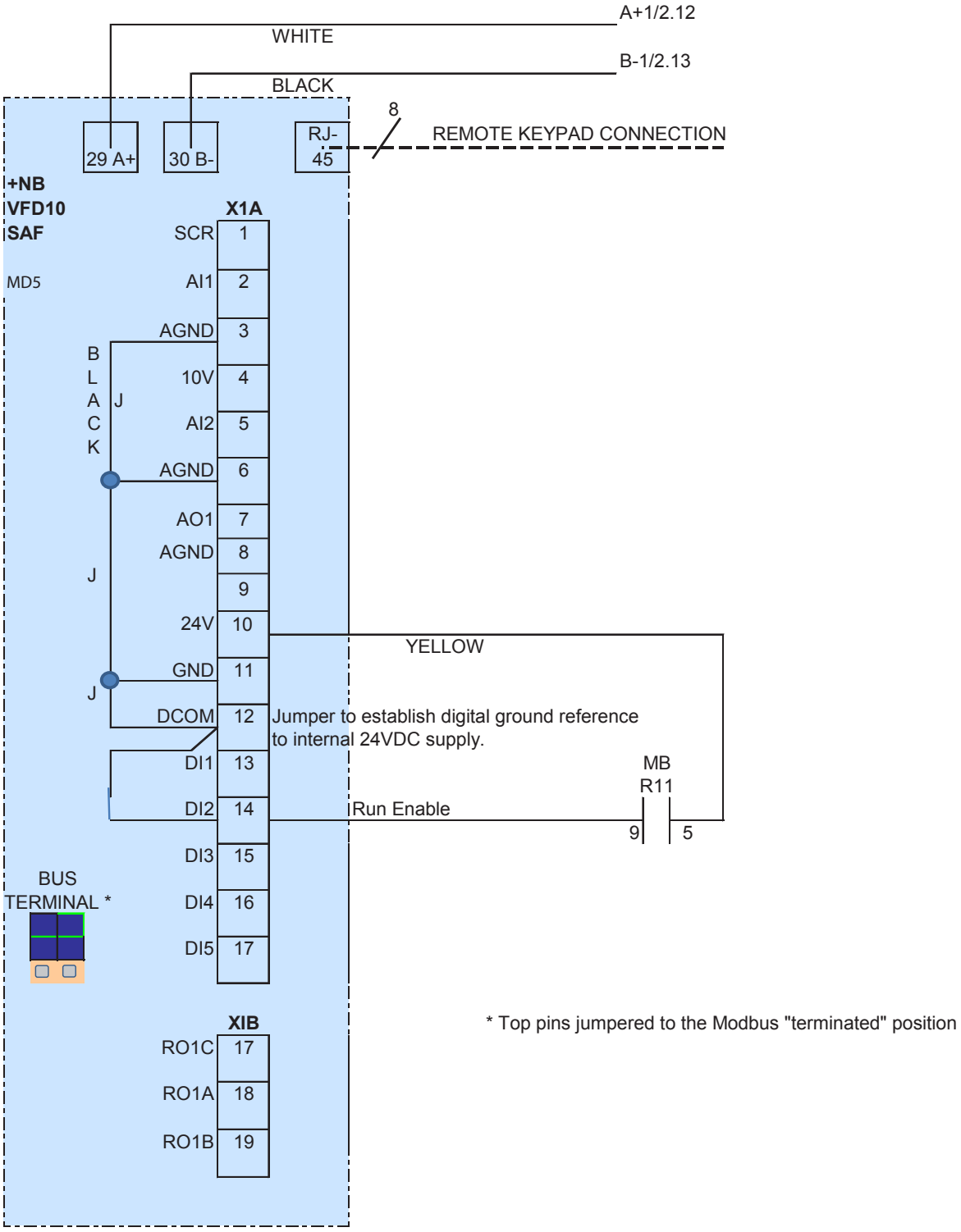


Figure 17: MD5 RoofPak — Energy Recovery Wheel, Frost Control Option



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